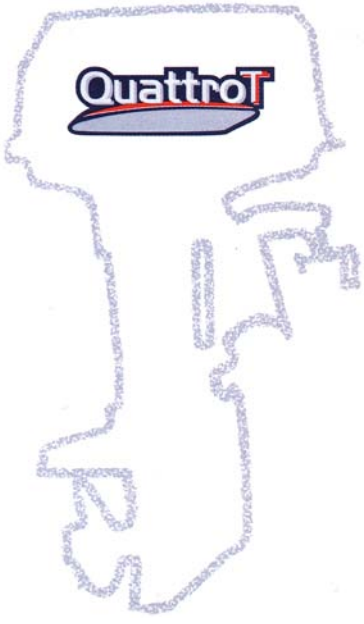
Pike 9,9

SERVICE MANUAL



SELVA Marine

NOTICE

This manual has been prepared by Selva primarily for use by Selva dealers and their trained mechanics when performing maintenance procedures and repairs to Selva equipment. It has been written to suit the needs of persons who have a basic understanding of the mechanical and electrical concepts and procedures inherent in the work, for without such knowledge attempted repairs or service to the equipment could render it unsafe or unfit for use.

Because Selva has a policy of continuously improving its products, models may differ in detail from the descriptions and illustrations given in this publication. Use only the latest edition of this manual. Authorized Selva dealers are notified periodically of modifications and significant changes in specifications and procedures, and these are incorporated in successive editions of this manual.

Important information

Particularly important information is distinguished in this manual by the following notations:

⚠ The Safety Alert Symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

⚠ WARNING

Failure to follow WARNING instructions could result in severe injury or death to the machine operator, a bystander, or a person inspecting or repairing the outboard motor.

CAUTION:

A CAUTION indicates special precautions that must be taken to avoid damage to the outboard motor.

NOTE:

A NOTE provides key information to make procedures easier or clearer.

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How to use this manual

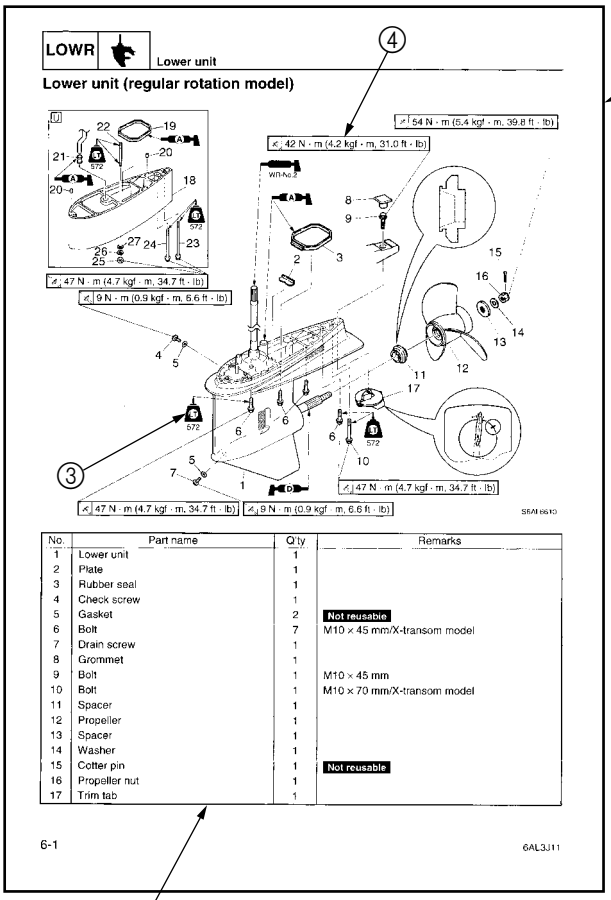
Manual format

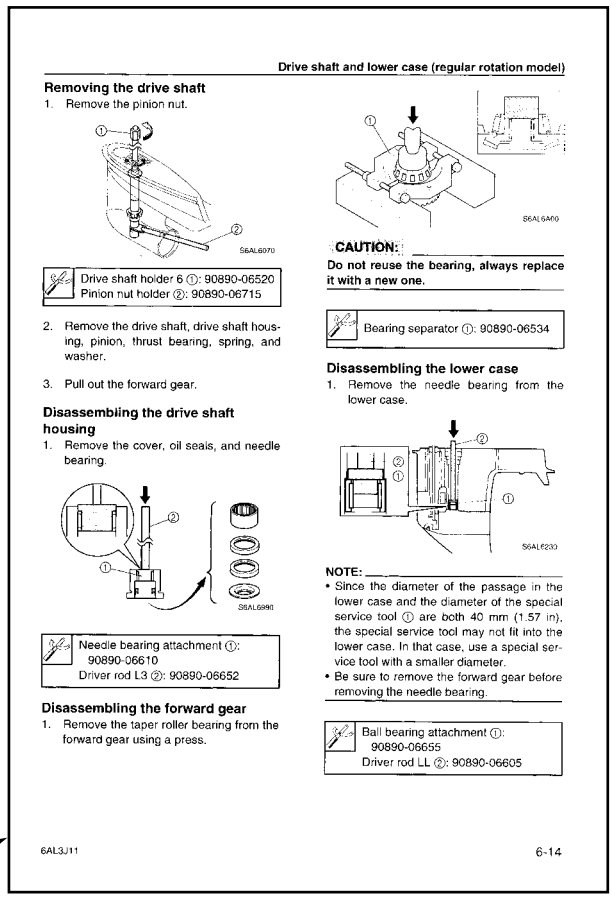
The format of this manual has been designed to make service procedures clear and easy to understand. Use the information below as a guide for effective and quality service.

- Parts are shown and detailed in an exploded diagram and are listed in the component list (see ① in the figure below for an example page).
- The component list consists of part names and quantities, as well as bolt and screw dimensions (see ② in the figure below).
- Symbols are used to indicate important aspects of a procedure, such as the grade of lubricant and lubrication point (see ③ in the figure below).
- Tightening torque specifications are provided in the exploded diagrams (see ④ in the figure below for an example), and in the related detailed instructions. Some torque specifications are listed in stages as torque figures or angles in degrees.
- Separate procedures and illustrations are used to explain the details of removal, checking, and installation where necessary (see ⑤ in the figure below for an example page).

NOTE:

For troubleshooting procedures, see Chapter 9, “Troubleshooting.”

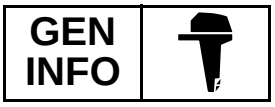

LOWR
Lower unit
Lower unit (regular rotation model)
No. Part name Q'ty Remarks
1 Lower unit 1
2 Plate 1
3 Rubber seal 1
4 Check screw 1
5 Gasket 2 Not reusable
6 Bolt 7 M10 × 45 mm/X-transom model
7 Drain screw 1
8 Grommet 1
9 Bolt 1 M10 × 45 mm
10 Bolt 1 M10 × 70 mm/X-transom model
11 Spacer 1
12 Propeller 1
13 Spacer 1
14 Washer 1
15 Cotter pin 1 Not reusable
16 Propeller nut 1
17 Trim tab 1
6-1
6AL3J11


Drive shaft and lower case (regular rotation model)
Removing the drive shaft
Drive shaft holder 6 ①: 90890-06520
Pinion nut holder ②: 90890-06715
CAUTION:
Do not reuse the bearing, always replace it with a new one.
Bearing separator ①: 90890-06534
Disassembling the drive shaft housing
Needle bearing attachment ①: 90890-06610
Driver rod L3 ②: 90890-06652
Disassembling the lower case
Ball bearing attachment ①: 90890-06655
Driver rod LL ②: 90890-06605
Disassembling the forward gear
6AL3J11
6-14

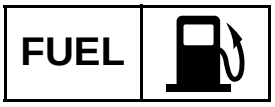
Symbol

The symbols below are designed to indicate the content of a chapter.

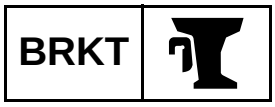
General information



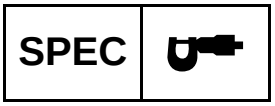
Fuel system



Bracket unit

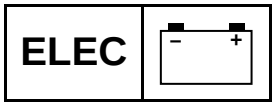


Specification

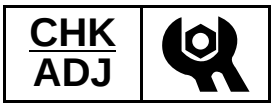


Power unit

Electrical system

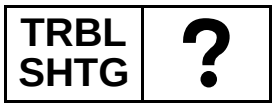


Periodic check and adjustment

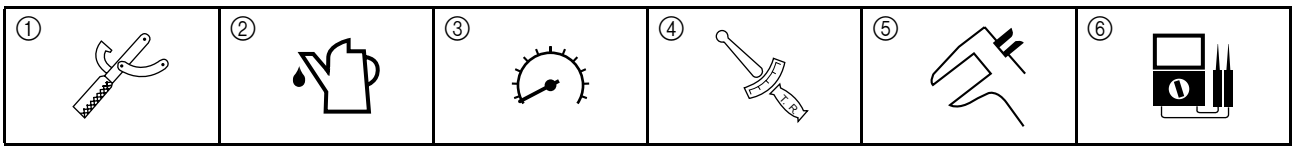


Lower unit

Troubleshooting

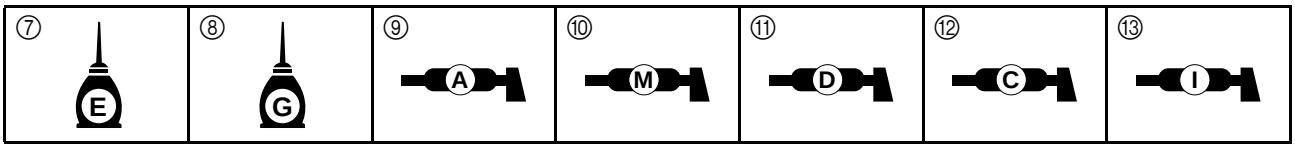


Symbols ① to ⑥ indicate specific data.



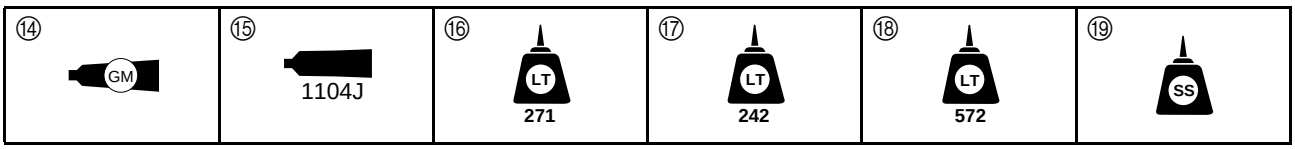
① Special service tool
② Specified oil or fluid
③ Specified engine speed
④ Specified tightening torque
⑤ Specified measurement
⑥ Specified electrical value (resistance, voltage, electric current)

Symbols ⑦ to ⑬ in an exploded diagram or illustration indicate the grade of lubricant and the lubrication point.



⑦ Apply 4-stroke motor oil
⑧ Apply gear oil
⑨ Apply water resistant grease
⑩ Apply molybdenum disulfide grease
⑪ Apply corrosion resistant grease
⑫ Apply low temperature resistant grease
⑬ Apply injector grease

Symbols ⑭ to ⑲ in an exploded diagram or illustration indicate the type of sealant or locking agent and the application point.



⑭ Apply Gasket Maker
⑮ Apply ThreeBond 1104J
⑯ Apply LOCTITE 271 (red)
⑰ Apply LOCTITE 242 (blue)
⑱ Apply LOCTITE 572
⑲ Apply silicone sealant

Abbreviation

The following abbreviations are used in this service manual.

Abbreviation	Description
API	American Petroleum Institute
BOW	Bow end
BTDC	Before Top Dead Center
CCA	Cold Cranking Ampere
CDI	Capacitor Discharge Ignition
E model	Electric starter model
EN	European Norm (European standard)
EX	Exhaust
F position	Forward position
H model	Tiller handle model
IEC	International Electrotechnical Commission
IN	Intake
M model	Manual starter model
MT	Manual tilt
N position	Neutral position
PORT	Port side
PT	Power tilt
R model	Remote control model
R position	Reverse position
SAE	Society of Automotive Engineers
STBD	Starboard side
WD	Wiring Diagram

Sealant and locking agent table

The following table contains sealants, locking agents, and lubricants used in this service manual that are not listed on page 1-2.

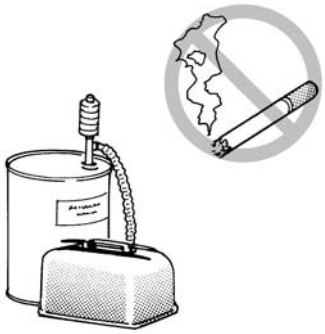
Symbol	Name	Application	Manufacturer
518	LOCTITE 518	Sealant	Henkel
1207B	ThreeBond 1207B	Sealant	ThreeBond
ME-1	ME-1	Antirust lubricant	

Safety while working

To prevent an accident or injury and to ensure quality service, follow the safety procedures provided below.

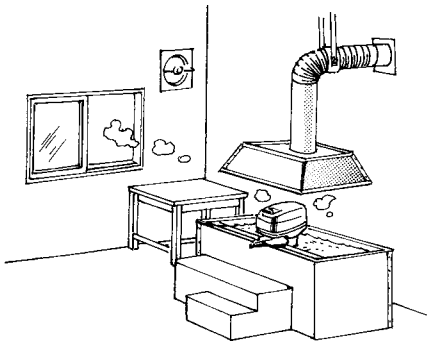
Fire prevention

Gasoline is highly flammable.
Keep gasoline and all flammable products away from heat, sparks, and open flames.


S69J1010

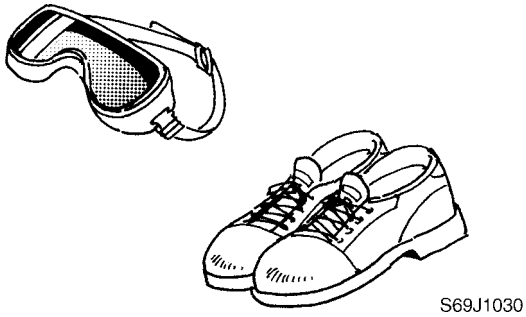
Ventilation

Gasoline vapor and exhaust gas are heavier than air and extremely poisonous. If inhaled in large quantities, they may cause loss of consciousness and death within a short time. When test running an engine indoors (e.g., in a water tank) be sure to do so where adequate ventilation can be maintained.


S69J1020

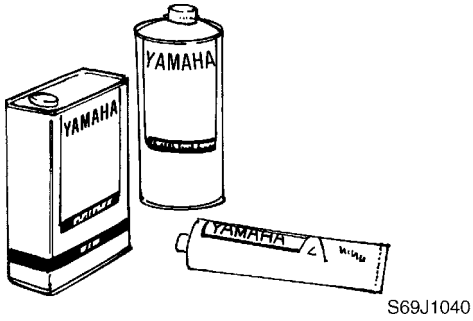
Self-protection

Protect your eyes by wearing safety glasses or safety goggles during all operations involving drilling and grinding, or when using an air compressor.
Protect your hands and feet by wearing protective gloves and safety shoes when necessary.


S69J1030

Part, lubricant, and sealant

Use only genuine Selva parts, lubricants, and sealants or those recommended by Selva, when servicing or repairing the outboard motor.



S69J1040

Under normal conditions, the lubricants mentioned in this manual should not harm or be hazardous to your skin. However, you should follow these precautions to minimize any risk when working with lubricants.

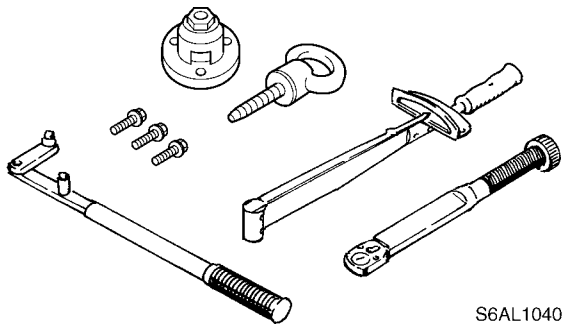
1. Avoid contact with skin. Do not, for example, place a soiled rag in your pocket.
2. Wash hands and any other part of the body thoroughly with soap and hot water after contact with a lubricant or lubricant soiled clothing has been made.
3. Change and wash clothing as soon as possible if soiled with lubricants.
4. To protect your skin, apply a protective cream to your hands before working on the outboard motor.
5. Keep a supply of clean, lint-free cloths for wiping up spills, etc.

6. Maintain good standards of personal and industrial hygiene.

Good working practice

Special service tool

Use the recommended special service tools to protect parts from damage. Use the right tool in the right manner—do not improvise.



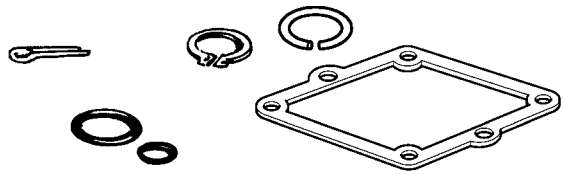
S6AL1040

Tightening torque

Follow the tightening torque specifications provided throughout the manual. When tightening nuts, bolts, and screws, tighten the large sizes first, and tighten fasteners starting in the center and moving outward.

Non-reusable part

Always use new gaskets, seals, O-rings, cotter pins, circlips, etc., when installing or assembling parts.

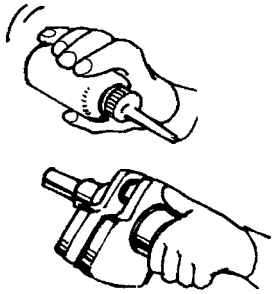


S69J1060

Disassembly and assembly

1. Use compressed air to remove dust and dirt during disassembly.

2. Apply oil or fluid to the contact surfaces of moving parts before assembly.



S69J1070

3. Install bearings with the manufacture identification mark in the direction indicated in the installation procedure. In addition, be sure to lubricate the bearings liberally.

4. Apply a thin coat of water resistant grease to the lip and periphery of an oil seal before installation.

5. Check that moving parts operate normally after assembly.

Identification

Model

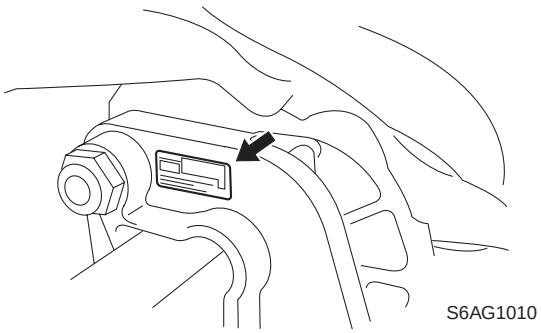
This manual covers the following models.

Applicable model
Pike 9.9

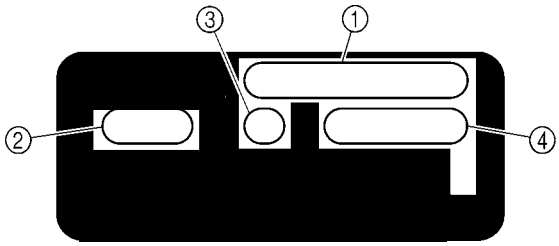
Serial number

The outboard motor serial number is stamped on a label attached to the port clamp bracket.

A



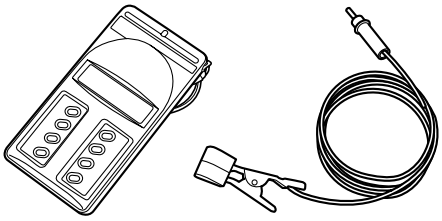
S6AG1010



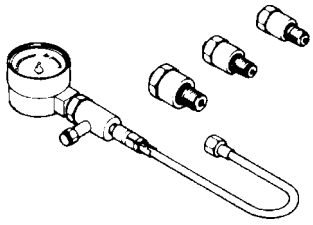
S6AL1D00

① Model name
② Approved model code
③ Transom height
④ Serial number

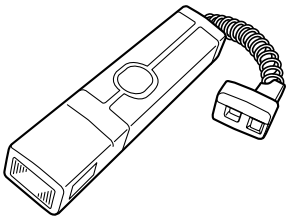
Special service tool



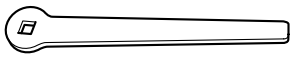
Digital tachometer
90890-06760



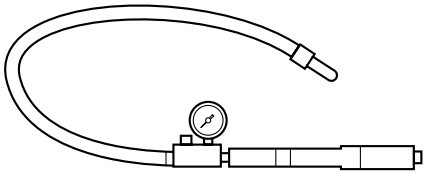
Compression gauge
90890-03160



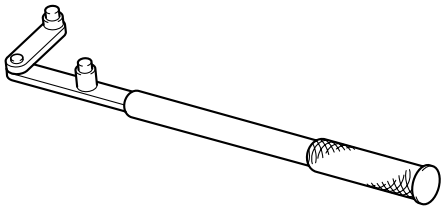
Timing light
90890-03141



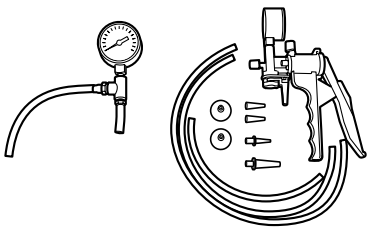
Tappet adjusting tool
90890-01311



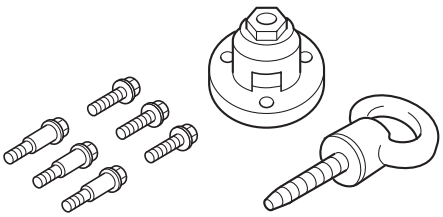
Leakage tester
90890-06840



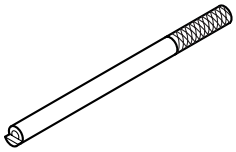
Flywheel holder
90890-06522



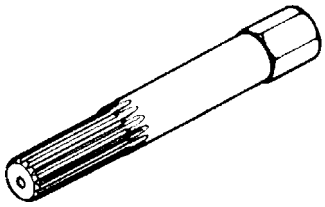
Vacuum/pressure pump gauge set
90890-06756



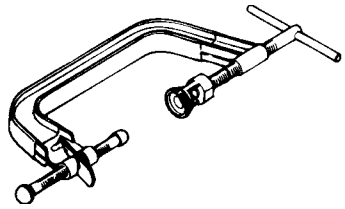
Flywheel puller
90890-06521



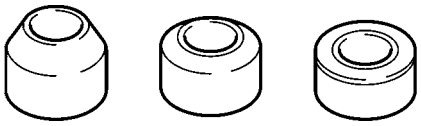
Pilot screw adjusting tool
90890-03154



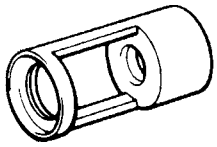
Shaft holder
90890-06561



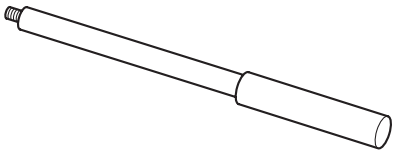
Valve spring compressor
90890-04019



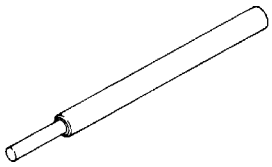
Valve seat cutter
90890-06312, 90890-06315, 90890-06328, 90890-06813, 90890-06814, 90890-06815



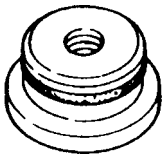
Valve spring compressor attachment
90890-06320



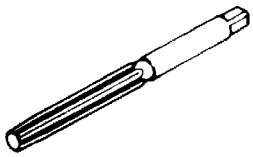
Driver rod L3
90890-06652



Valve guide remover/installer
90890-06801



Needle bearing attachment
90890-06613, 90890-06614, 90890-06616, 90890-06653



Valve guide reamer
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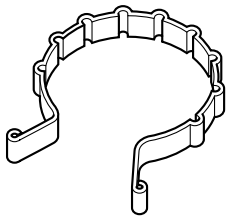
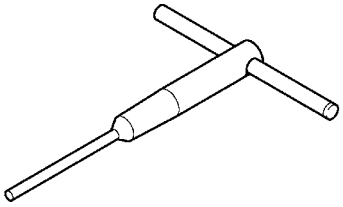
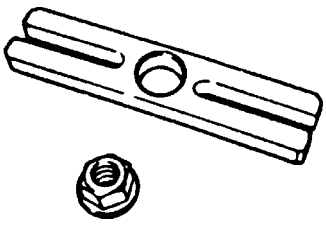


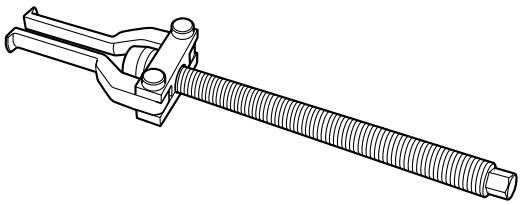
Piston slider
90890-06843



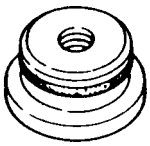
Valve seat cutter holder
90890-06316



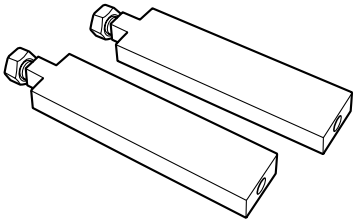
Stopper guide plate
90890-06501



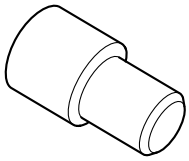
Bearing puller assembly
90890-06535



Ball bearing attachment
90890-06634



Stopper guide stand
90890-06538



Bushing attachment
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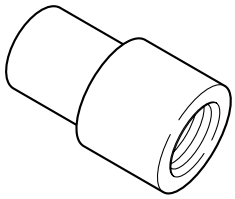

Bushing attachment
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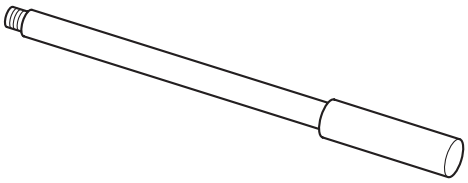
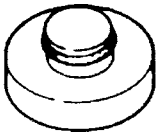
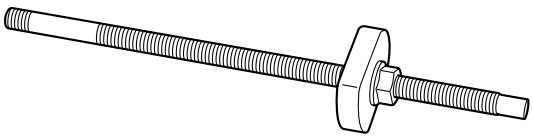


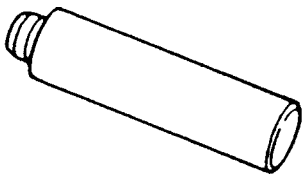
Driver rod LL
90890-06605



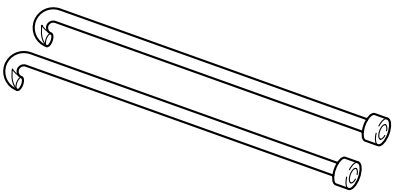
Needle bearing attachment
90890-06617



Bushing installer center bolt
90890-06601



Driver rod LS
90890-06606



Bearing housing puller claw S
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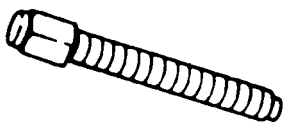
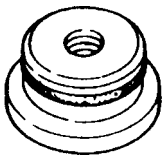
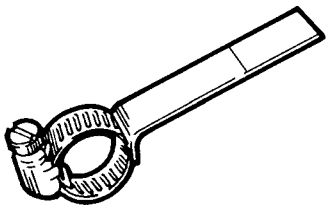


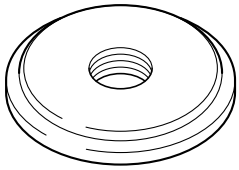
Center bolt
90890-06504



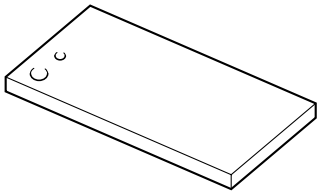
Ball bearing attachment
90890-06632



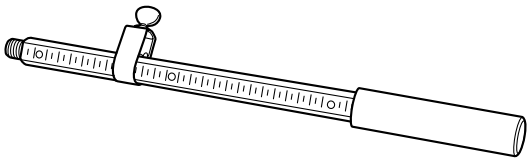
Backlash indicator
90890-06706



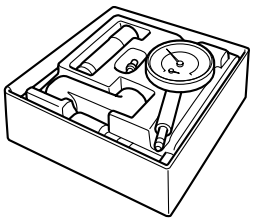
Bearing outer race attachment
90890-06625



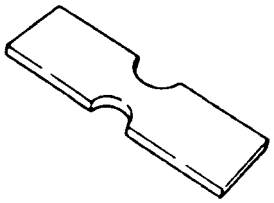
Magnet base plate
90890-07003



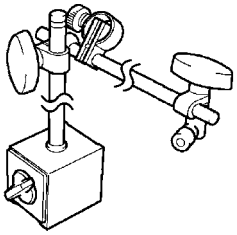
Driver rod SL
90890-06602



Dial gauge set
90890-01252



Bearing depth plate
90890-06603



Magnet base B
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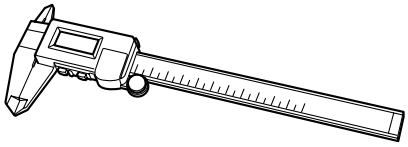
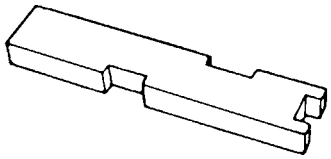
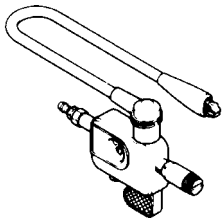


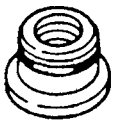
Digital caliper
90890-06704



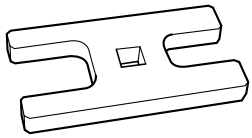
Shimming plate
90890-06701



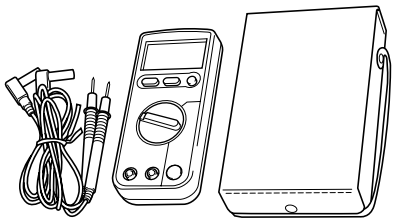
Ignition tester
90890-06754



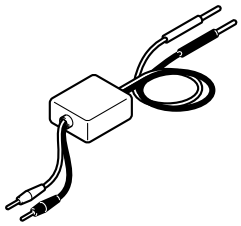
Needle bearing attachment
90890-06615



Power tilt wrench
90890-06560



Digital circuit tester
90890-03174



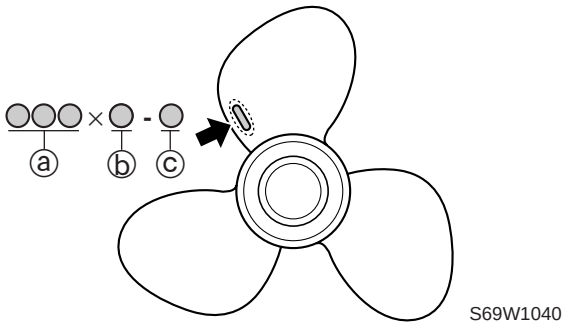
Peak voltage adapter B
90890-03172

Propeller selection

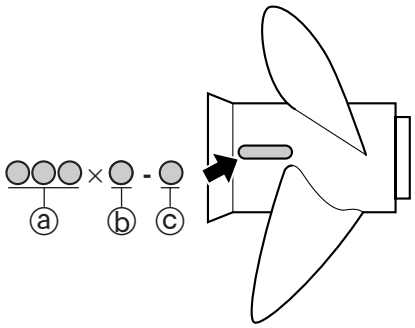
The performance of a boat and outboard motor will be critically affected by the size and type of propeller you choose. Propellers greatly affect boat speed, acceleration, engine life, fuel economy, and even boating and steering capabilities. An incorrect choice could adversely affect performance and could also seriously damage the engine.
Use the following information as a guide for selecting a propeller that meets the operating conditions of the boat and the outboard motor.

Propeller size

The size of the propeller is indicated on a propeller blade and on the side of the propeller boss.



S69W1040



S69W1050

ⓐ Propeller diameter (in inches)
ⓑ Propeller pitch (in inches)
ⓒ Propeller type (propeller mark)

Selection

When the engine speed is at the full throttle operating range (5,000–6,000 r/min), the ideal propeller for the boat is one that provides maximum performance in relation to boat speed and fuel consumption.

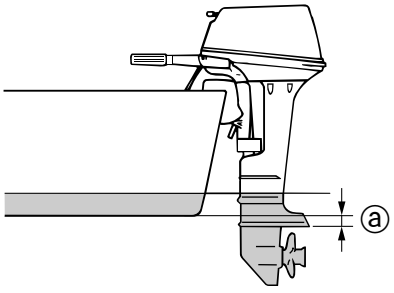
Model	Propeller size (in)	Material
Pike 9.9	8 1/2 × 6 1/2 - N	Aluminum
	8 1/2 × 7 1/2 - N	
	8 1/2 × 8 - N	
	8 1/2 × 8 1/2 - N	
	8 1/2 × 9 1/4 - N	
	9 × 5 - N	
	9 × 7 - N	

Predelivery check

To make the delivery process smooth and efficient, the predelivery checks should be completed as explained below.

Checking the outboard motor mounting height

1. Check that the anti-cavitation plate is between the bottom of the boat and a maximum of 25 mm (1 in) ⓐ below it. If the mounting height is too high, cavitation will occur and propulsion will be reduced. Also, the engine speed will increase abnormally and cause the engine to overheat. If the mounting height is too low, water resistance will increase and reduce engine efficiency.



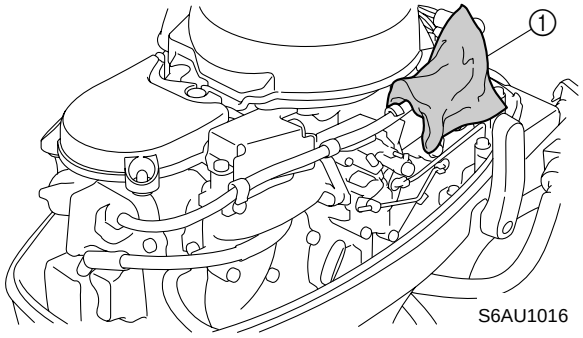
S6D51030

NOTE:
The optimum mounting height is affected by the combination of the boat and the outboard motor. To determine the optimum mounting height, test run the outboard motor at different heights.

2. Check that the clamp brackets are secured with the clamp bolts.

Removing the intake silencer protective covering

1. Remove the protective covering ① from the intake silencer.

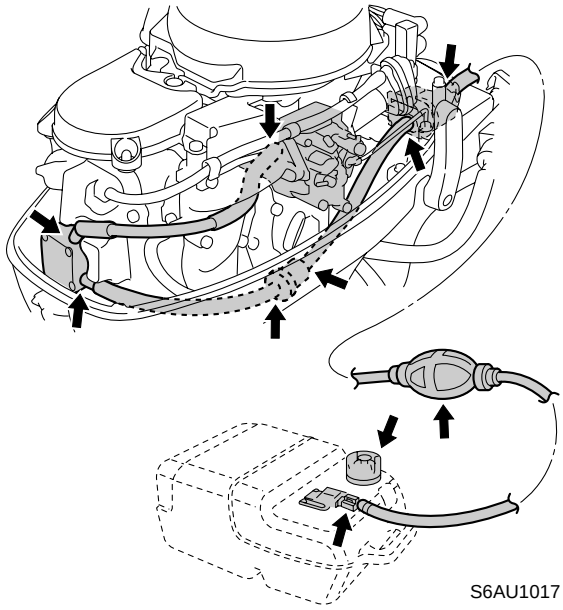


S6AU1016

CAUTION:
A protective covering ① is installed on the intake silencer when the outboard motor is shipped from the factory and must be removed before starting the engine for the first time.

Checking the fuel system

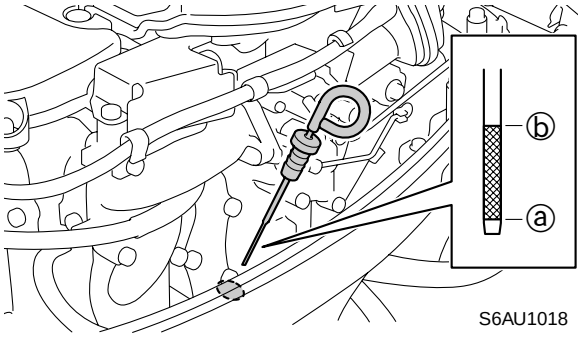
1. Check that the fuel hoses are securely connected and that the fuel tank is full with fuel.


S6AU1017

CAUTION:
This is a 4-stroke engine. Never use premixed fuel or 2-stroke outboard motor oil.

Checking the engine oil level

1. Check the engine oil level.



S6AU1018

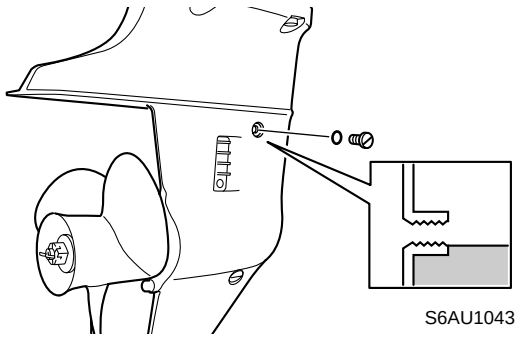
NOTE:
If the engine oil is below the minimum level mark ⓐ, add sufficient oil until the level is between ⓐ and ⓑ.

Recommended engine oil:
4-stroke motor oil
API: SE, SF, SG, SH, SJ, or SL
SAE: 5W-30, 10W-30, or 10W-40
Engine oil quantity:
0.8 L (0.85 US qt, 0.70 Imp qt)

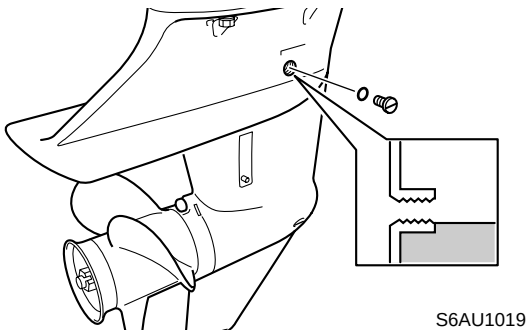
Checking the gear oil level

1. Check the gear oil level.

A


S6AU1043

B


S6AU1019

A Except for high thrust model
B For high thrust model

NOTE:
If the oil is at the correct level, a small amount of oil should overflow out of the check hole when the gear oil check screw is removed.

Checking the battery (E model)

1. Check the battery capacity, electrolyte level, and specific gravity of the electrolyte.

Recommended battery capacity:
CCA/EN: 347.0 A
20HR/IEC: 40.0 Ah
Electrolyte specific gravity:
1.280 at 20 °C (68 °F)

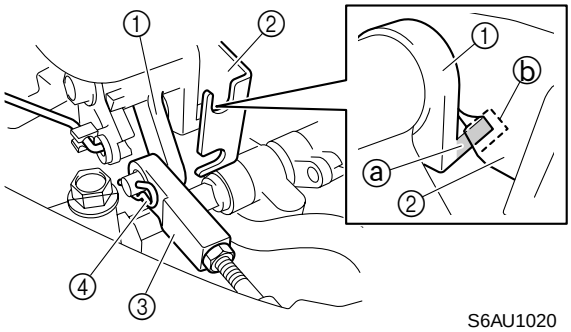
2. Check that the positive and negative battery cables are securely connected.

Connecting the throttle cable and shift cable (R model)

NOTE:
To adjust the throttle cable and shift cable, see “Adjusting the throttle cable (R model)” (3-8) or “Checking the gear shift operation (R model)” (3-10).

1. Set the remote control lever to the N position and the throttle lever to the fully closed position.

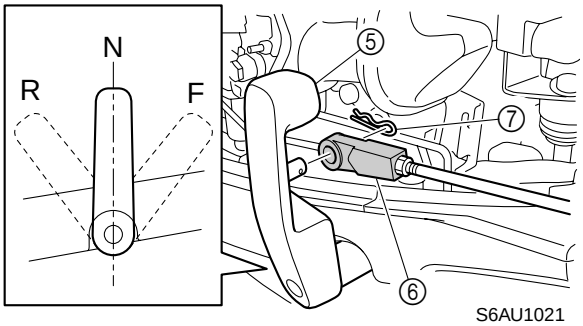
2. Turn the throttle cam ① counterclockwise until the fully closed stopper ⓐ on the cam contacts the fully closed stopper ⓑ on the throttle cable bracket ② and hold it in that position. Connect the throttle cable ③ to the throttle cam, and then install the clip ④.



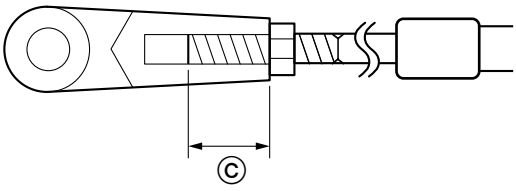
S6AU1020

NOTE:
Pull the throttle cable ③ toward the engine to remove any free play in the cable before connecting the throttle cable joint.

3. Check that the shift lever ⑤ is in the N position as shown. Connect the shift cable ⑥ to the shift lever, and then install the clip ⑦.



S6AU1021



S6AU1022

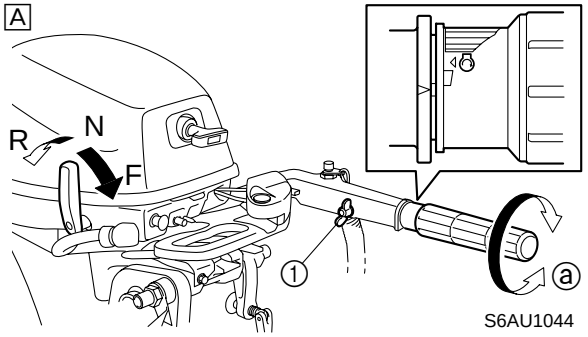
⚠ WARNING

The shift/throttle cable joint must be screwed in a minimum of 8.0 mm (0.31 in) ⓒ.

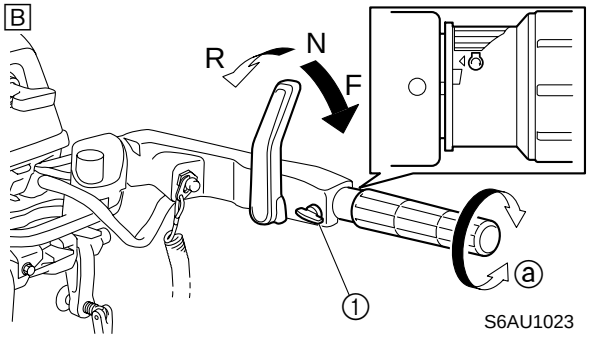
Checking the gear shift and throttle operation

1. Check that the throttle operates smoothly when the throttle grip is turned from the fully closed position to the fully open position ⓐ. (H model)
   Check that the throttle operates smoothly when the remote control lever is shifted from the F position or R position to the fully open position ⓐ. (R model)

2. Check that the gear shift operates smoothly when the shift lever or remote control lever is shifted from the N position to the F position or R position.

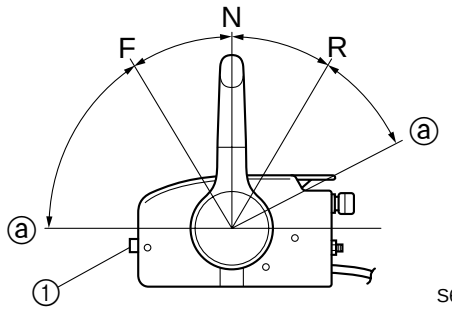


S6AU1044



S6AU1023

C



S6AU1024

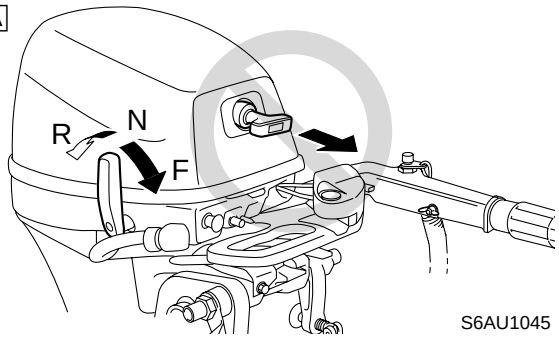
A H model (short)
B H model (long)
C R model

NOTE:

The resistance of the throttle grip (H model) or remote control lever (R model) can be adjusted using the throttle friction adjuster ①.

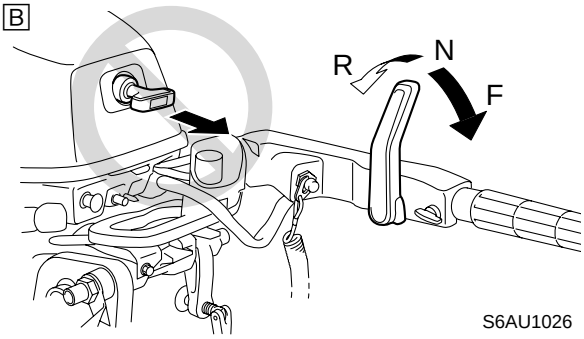
3. Set the shift lever to the F position or R position, and then check that the starter handle cannot be pulled. If the starter rope can be pulled out normally, adjust the start-in-gear protection cable. (M model)

A



S6AU1045

B



S6AU1026

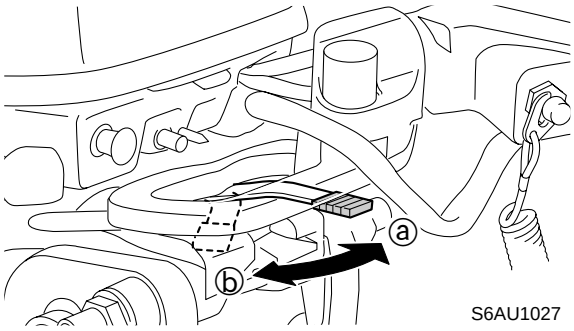
A H model (short)
B H model (long)

NOTE:

To adjust the start-in-gear protection cable, see “Checking the start-in-gear protection (M model)” (3-11).

Checking the steering system

1. Check the steering friction for proper adjustment. (H model)



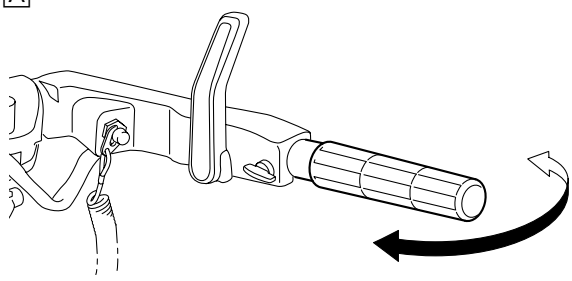
S6AU1027

NOTE:

- To increase the friction, move the steering lock lever in direction ⓐ.
- To decrease the friction, move the steering lock lever in direction ⓑ.

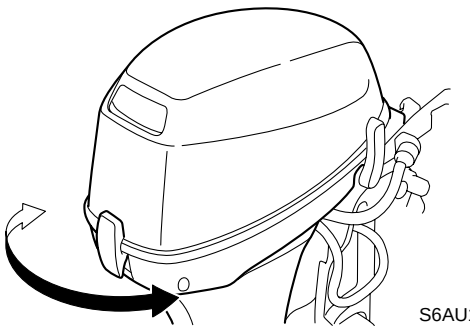
2. Check that the steering operates smoothly.

A



S6AU1028

B



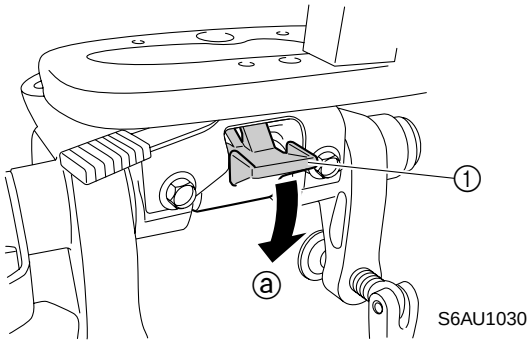
S6AU1029

A H model
B R model

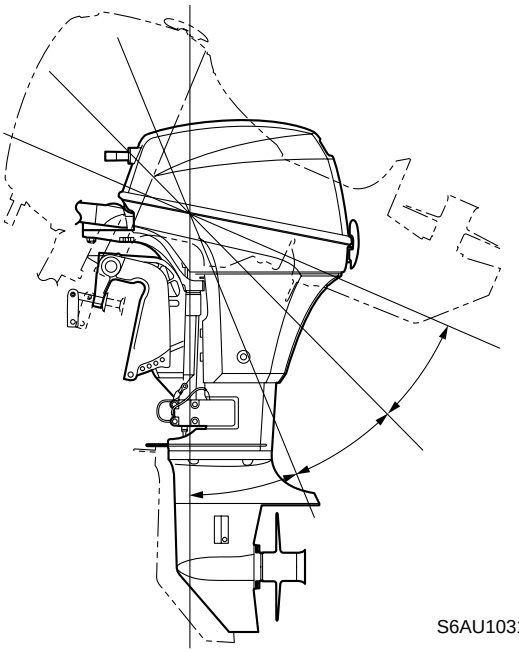
3. Check that there is no interference with leads, cables, or hoses when the outboard motor is steered.

Checking the tilt system (MT model)

1. Set the tilt lock lever ① to the release position ⓐ and fully tilt the outboard motor up. Check that the outboard motor tilts up smoothly and automatically locks in 3 positions when it is tilted up.

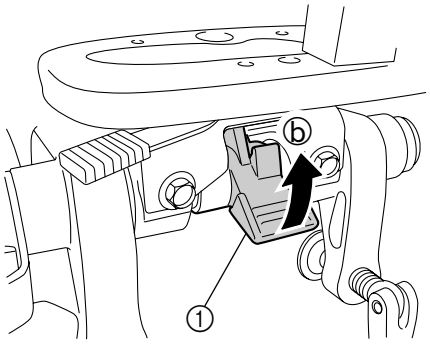


S6AU1030


S6AU1031

2. Check that there is no interference with leads, cables, or hoses when the tilted-up outboard motor is steered.

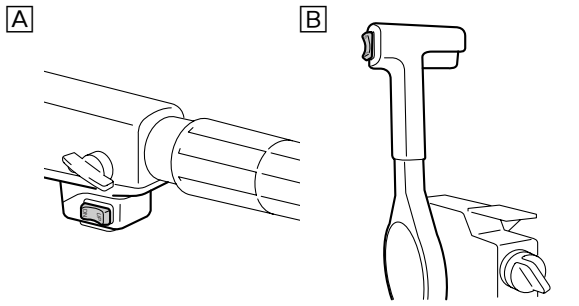
3. Set the tilt lock lever ① to the lock position ⓑ, slightly tilt the outboard motor up, and then fully tilt it down. Check that the outboard motor tilts down smoothly and automatically locks in the fully tilted down position.



S6AU1032

Checking the PT system (PT model)

1. Check that the outboard motor tilts up and down smoothly when operating the PT switch.



S6AU1033

A H model
B R model

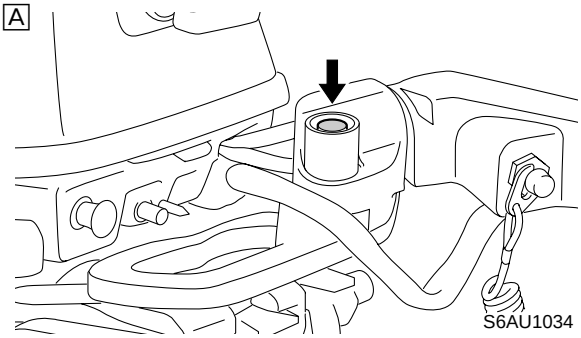
2. Check that there is no abnormal noise produced when the outboard motor is tilted up or down.

3. Check that there is no interference with leads, cables, or hoses when the tilted-up outboard motor is steered.

Checking the engine start button or switch and engine shut-off switch

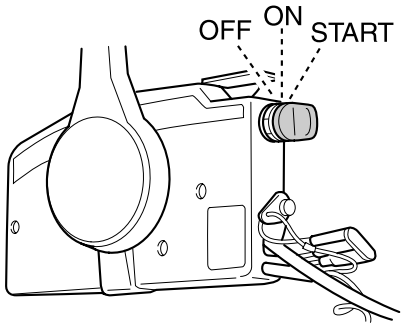
1. Check that the engine starts when the engine start button is pushed. (H model)
   Check that the engine starts when the engine start switch is turned to “START.” (R model)

A



S6AU1034

B

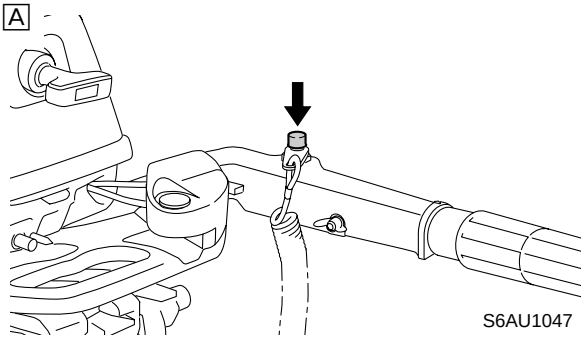


S6AU1035

A H model
B R model

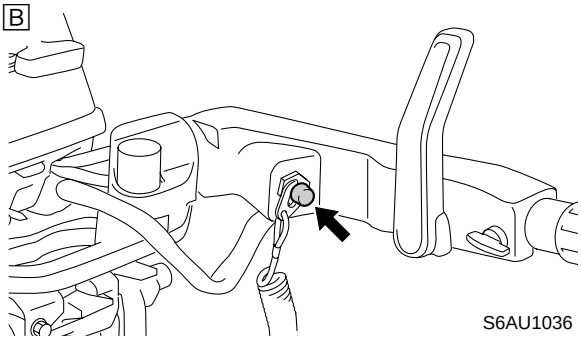
2. Check that the engine turns off when the engine shut-off switch is pushed. (H model)
   Check that the engine turns off when the engine start switch is turned to “OFF.” (R model)

A



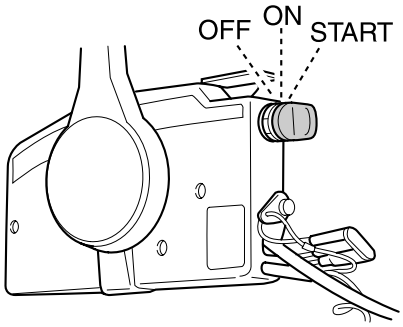
S6AU1047

B



S6AU1036

C

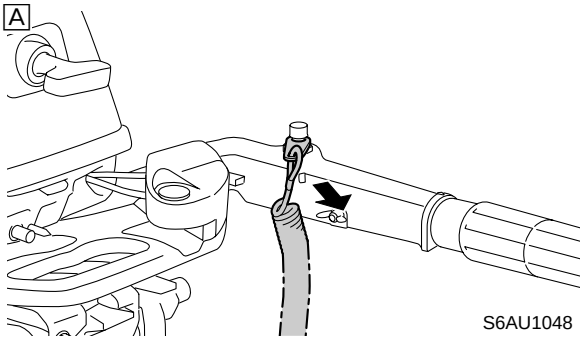


S6AU1035

A H model (short)
B H model (long)
C R model

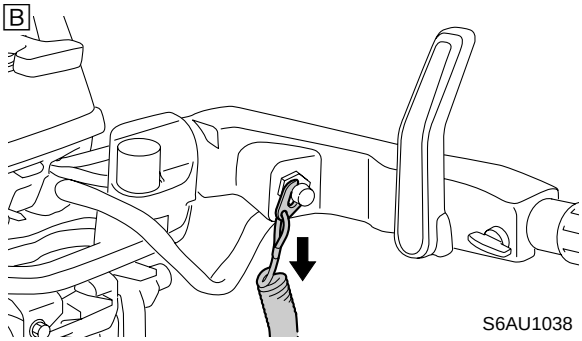
3. Check that the engine turns off when the clip is pulled from the engine shut-off switch.

A



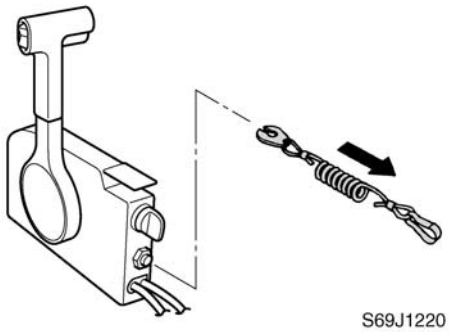
S6AU1048

B



S6AU1038

C



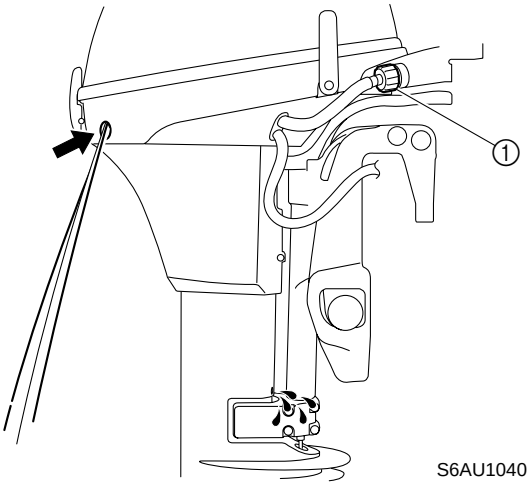
S69J1220

A H model (short)
B H model (long)
C R model

Checking the cooling water pilot hole

1. Place the lower unit in water, and then start the engine.

2. Check for water flow at the cooling water pilot hole.



NOTE:
Make sure that the cooling water hoses are securely connected and that the flushing hose joint adapter ① (for Europe) is not loose or damaged.

Test run

1. Start the engine, and then check that the gear shift operates smoothly.

2. Check the engine idle speed after the engine has been warmed up.

3. Operate at trolling speed.

4. Run the outboard motor for 1 hour at varying speeds up to 2,000 r/min or approximately half throttle, then, for another hour, increase engine speed as much as necessary to put the boat on plane (but avoid full-throttle operation).

5. Check that the outboard motor does not tilt up when shifting into reverse and that water does not flow in over the transom.

NOTE:
The test run is part of the break-in operation.

Break-in

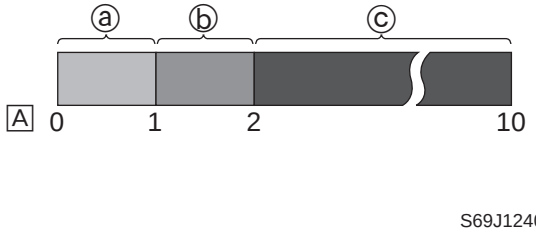
Run the engine under load (in gear with a propeller installed) for 10 hours as follows.

1. For the 1st hour ⓐ of operation:
   Run the engine at varying speeds up to 2,000 r/min or approximately half throttle.

2. For the 2nd hour ⓑ of operation:
   Increase engine speed as much as necessary to put the boat on plane (but avoid full-throttle operation), then back off on the throttle while keeping the boat at a planing speed.

3. Remaining 8 hours ⓒ:
   Run the engine at any speed. However, avoid operating at full throttle for more than 5 minutes at a time.

4. After the 1st 10 hours:
   Operate the engine normally.



A Hour

After test run

1. Check for water in the gear oil.

2. Check for fuel leakage in the cowling.

3. Flush the cooling water passages with fresh water using the flushing kit and with the engine running at idle.

CAUTION:

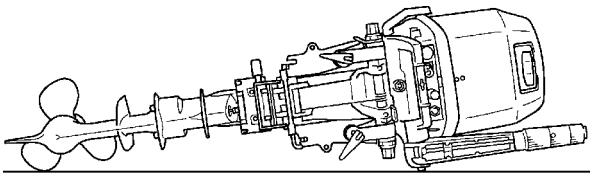
Be sure to supply sufficient water and water pressure when flushing the cooling water passages. If sufficient water and sufficient water pressure are not supplied, the engine can overheat.

NOTE:

When using the flushing device (flushing hose joint adapter [for Europe]), flush the cooling water passages without starting the engine.

Precaution when transporting or storing the outboard motor

1. When transporting or storing the outboard motor while removed from a boat, keep the outboard motor in the attitude shown or use an outboard motor stand.



S6AU1042

— MEMO —

Specification

General specification 2-1

Maintenance specification 2-4
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Fuel system 2-7
Lower unit 2-8
Electrical 2-9
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Tightening torque 2-19
Specified torque 2-19
General torque 2-21

General specification

Item	Unit	Model			
		Pike 9.9			
Dimension					
Overall length					
(For Europe)	mm (in)	927 (36.5)	1,038 (40.9)	573 (22.6)	
(For Oceania)	mm (in)	1,038 (40.9)	—	573 (22.6)	
Overall width					
(For Europe)	mm (in)	377 (14.8)	371 (14.6)	335 (13.2)	
(For Oceania)	mm (in)	371 (14.6)	—	335 (13.2)	
Overall height					
(S)	mm (in)	998 (39.3)	—		
(L)	mm (in)	1,125 (44.3)	1,187 (46.7)		
(X)	mm (in)	—	1,255 (49.4)		
Transom height					
(S)	mm (in)	430 (16.9)	—		
(L)	mm (in)	557 (21.9)	552 (21.7)		557 (21.9)
(X)	mm (in)	—	620 (24.4)		625 (24.6)
Boat transom height					
(S)	mm (in)	381 (15.0)	—		
(L)	mm (in)	508 (20.0)			
(X)	mm (in)	—	635 (25.0)		
Weight					
(with aluminum propeller)					
(S)					
(For Europe)	kg (lb)	39.9 (88)	—		
(For Oceania)	kg (lb)	41.5 (92)	—		
(L)					
(For Europe)	kg (lb)	40.9 (90)	44.3 (98)	44.4 (98)	49.1 (108)
(For Oceania)	kg (lb)	42.5 (94)	—	44.4 (98)	49.1 (108)
(X)	kg (lb)	—	45.4 (100)	45.5 (100)	50.2 (111)

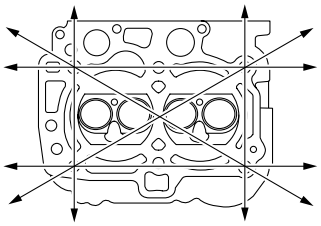
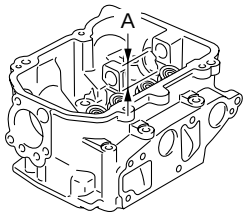
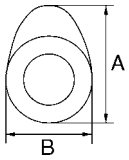
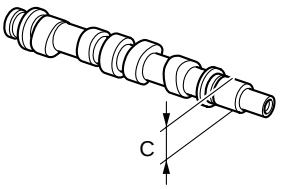
Item	Unit	Model			
		Pike 9.9			
Performance					
Maximum output	kW (HP)	7.3 (9.9) at 5,500 r/min			
Full throttle operating range	r/min	5,000–6,000			
Maximum fuel consumption	L (US gal, Imp gal)/hr	3.9 (1.0, 0.9) at 6,000 r/min			
Engine idle speed	r/min	1,050 ± 50			
Power unit					
Type		4-stroke L			
Cylinder quantity		2			
Total displacement	cm^3 (cu. in)	212 (12.9)			
Bore × stroke	mm (in)	56.0 × 43.0 (2.20 × 1.69)			
Compression ratio		9.4			
Control system		Tiller handle		Remote control	
Starting system		Manual		Electric	
Fuel system		Carburetor			
Enrichment system		Choke valve			
Ignition control system		CDI (micro computer)			
Advanced type		Micro computer			
Ignition timing at 1,050 r/min	Degree	BTDC 5 ± 3			
Maximum generator output	V, W	12, 80		—	
	V, A	—		12, 6.0	
Spark plug		BR6HS-10 (NGK)			
Cooling system		Water			
Exhaust system		Propeller boss			
Lubrication system		Wet sump			
Fuel and oil					
Fuel type		Regular unleaded gasoline			
Engine oil type		4-stroke motor oil			
Engine oil grade(*1)	API	SE, SF, SG, SH, SJ, or SL			
	SAE	5W-30, 10W-30, or 10W-40			
Engine oil quantity	L (US qt, Imp qt)	0.8 (0.85, 0.70)			
Gear oil type		Hypoid gear oil			
Gear oil grade(*2)	API	GL-4			
	SAE	90			
Gear oil quantity	cm^3 (US oz, Imp oz)	150 (5.07, 5.29)	370 (12.51, 13.05)		

(*1) If the recommended engine oil grades are not available, use engine oil with an API classification of SH, SJ, or SL and an SAE classification of 15W-40, 20W-40, or 20W-50.
(*2) Meeting both API and SAE requirements

Item	Unit	Model			
		Pike 9.9			
Bracket unit					
Trim angle (at 12° boat transom)	Degree	0.0, 4.0, 8.0, 12.0			—
Tilt-up angle	Degree	71			74
Steering angle	Degree	43 + 43			38 + 38
PT system					
Fluid type		—			ATF Dexron II
Drive unit					
Gear shift positions		F-N-R			
Gear ratio		2.08 (27/13)	2.92 (38/13)		
Reduction gear type		Straight bevel gear	Spiral bevel gear		
Clutch type		Dog clutch			
Propeller shaft type		Spline			
Propeller direction (rear view)		Clockwise			
Propeller mark		N	R		
Electrical					
Battery minimum capacity					
CCA/EN	A	—			347.0
20HR/IEC	Ah	—			40.0
Electrolyte specific gravity at 20 °C (68 °F)		—			1.280

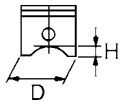
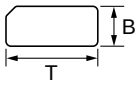
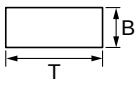
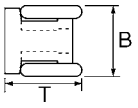
Maintenance specification

Power unit

Item	Unit	Model			
		Pike 9.9			
Power unit					
Minimum compression pressure(*1)	kPa (kgf/cm^2, psi)	630 (63, 91.4)		700 (7.0, 101.5)	
Cylinder head					
Warpage limit	mm (in)	0.10 (0.0039)			
 (lines indicate straightedge position)					
Cylinder head journal inside diameter (A)	mm (in)	18.000–18.018 (0.7087–0.7094)			
					
Camshaft					
Intake and exhaust (A) 	mm (in)	23.45–23.55 (0.9232–0.9272)			
Intake and exhaust (B)	mm (in)	19.95–20.05 (0.7854–0.7894)			
Camshaft journal diameter (C)	mm (in)	17.975–17.991 (0.7077–0.7083)			
					
Camshaft runout limit	mm (in)	0.03 (0.0012)			
Rocker arm shaft					
Outside diameter	mm (in)	12.941–12.951 (0.5095–0.5099)			

(*1) Measuring conditions:
Ambient temperature 20 °C (68 °F), wide open throttle, with spark plugs removed from all cylinders.
The figures are for reference only.

Item	Unit	Model			
		Pike 9.9			
Rocker arm					
Inside diameter	mm (in)	13.000–13.018 (0.5118–0.5125)			
Valve					
Valve clearance (cold)					
Intake	mm (in)	0.15–0.20 (0.006–0.008)			
Exhaust	mm (in)	0.20–0.25 (0.008–0.010)			
Head diameter (A)					
Intake	mm (in)	23.9–24.1 (0.94–0.95)			
Exhaust	mm (in)	21.9–22.1 (0.86–0.87)			
Face width (B)					
Intake and exhaust	mm (in)	1.84–2.26 (0.0724–0.0890)			
Seat contact width (C)					
Intake and exhaust	mm (in)	0.6–0.8 (0.024–0.031)			
Margin thickness (D)					
Intake	mm (in)	0.7 (0.028)			
Exhaust	mm (in)	1.0 (0.039)			
Stem diameter					
Intake	mm (in)	5.475–5.490 (0.2156–0.2161)			
Exhaust	mm (in)	5.460–5.475 (0.2150–0.2156)			
Stem runout limit	mm (in)	0.01 (0.0004)			
Guide inside diameter					
Intake and exhaust	mm (in)	5.500–5.512 (0.2165–0.2170)			
Stem-to-guide clearance					
Intake	mm (in)	0.010–0.037 (0.0004–0.0015)			
Exhaust	mm (in)	0.025–0.052 (0.0010–0.0020)			
Guide height	mm (in)	8.05 ± 0.25 (0.32 ± 0.01)			
Valve spring					
Free length	mm (in)	27.6 (1.0866)			
Tilt limit	mm (in)	1.0 (0.039)			
Cylinder					
Bore size	mm (in)	56.000–56.015 (2.2047–2.2053)			

Item	Unit	Model			
		Pike 9.9			
Piston					
Piston diameter (D) 	mm (in)	55.950–55.965 (2.2028–2.2033)			
Measuring point (H)	mm (in)	1.5 (0.06)			
Piston clearance(*1)	mm (in)	0.035–0.065 (0.0014–0.0026)			
Piston pin boss bore	mm (in)	14.004–14.015 (0.5513–0.5518)			
Oversize piston diameter					
1st	mm (in)	56.200–56.215 (2.2126–2.2132)			
2nd	mm (in)	56.450–56.465 (2.2224–2.2230)			
Piston ring groove					
Top ring	mm (in)	1.23–1.25 (0.0484–0.0492)			
2nd ring	mm (in)	1.52–1.54 (0.0598–0.0606)			
Oil ring	mm (in)	2.51–2.53 (0.0988–0.0996)			
Piston pin					
Outside diameter	mm (in)	13.996–14.000 (0.5510–0.5512)			
Piston ring					
Top ring		Barrel			
Dimension B 	mm (in)	1.17–1.19 (0.0461–0.0469)			
Dimension T	mm (in)	1.95–2.15 (0.0768–0.0846)			
End gap(*1)	mm (in)	0.15–0.30 (0.0059–0.0118)			
Side clearance	mm (in)	0.04–0.08 (0.0016–0.0031)			
2nd ring		Plain			
Dimension B 	mm (in)	1.47–1.49 (0.0579–0.0587)			
Dimension T	mm (in)	2.40–2.60 (0.0945–0.1024)			
End gap(*1)	mm (in)	0.30–0.45 (0.0118–0.0177)			
Side clearance	mm (in)	0.03–0.07 (0.0012–0.0028)			
Oil ring					
Dimension B 	mm (in)	2.35–2.50 (0.0925–0.0984)			
Dimension T	mm (in)	2.30–2.60 (0.0906–0.1024)			
End gap(*1)	mm (in)	0.20–0.70 (0.0079–0.0276)			
Side clearance	mm (in)	0.01–0.18 (0.0004–0.0071)			
Connecting rod					
Small end inside diameter	mm (in)	14.015–14.029 (0.5518–0.5523)			
Big end inside diameter	mm (in)	27.030–27.042 (1.0642–1.0646)			
Big end side clearance(*1)	mm (in)	0.05–0.22 (0.0020–0.0087)			
Crankpin oil clearance(*1)	mm (in)	0.021–0.045 (0.0008–0.0018)			
Crankshaft					
Crankshaft journal diameter	mm (in)	30.002–30.014 (1.0582–1.0586)			
Crankpin diameter	mm (in)	26.997–27.009 (1.0629–1.0633)			
Crankpin width	mm (in)	21.000–21.070 (0.8268–0.8295)			
Crankshaft runout limit	mm (in)	0.05 (0.0020)			

(*1) The figures are for reference only.

Item	Unit	Model			
		Pike 9.9			
Crankcase					
Crankshaft journal oil clearance(*1)	mm (in)	0.006–0.034 (0.0002–0.0013)			
Upper and lower crankcase main journal bearing thickness					
A - (Blue)	mm (in)	1.502–1.506 (0.0591–0.0593)			
B - (Black)	mm (in)	1.498–1.502 (0.0590–0.0591)			
C - (Brown)	mm (in)	1.494–1.498 (0.0588–0.0590)			
Oil pump					
Type		Trochoid			
Relief valve opening pressure	kPa (kgf/cm^2, psi)	390–450 (3.90–4.50, 56.6–65.3)			
Thermostat					
Opening temperature					
at 0.05 mm (0.0020 in)	°C (°F)	58–62 (136–144)			
Fully open temperature	°C (°F)	70 (158)			
Valve open lower limit	mm (in)	3.0 (0.12)			
Manual starter					
Starter rope length	mm (in)	1,900 (74.8)		—	
Starter rope pulling length	mm (in)	1,400–1,600 (55.12–62.99)		—	

(*1) The figures are for reference only.

Fuel system

Item	Unit	Model			
		Pike 9.9			
Carburetor					
ID mark					
(For Europe)		6AU20		6AU50	
(For Oceania)		6AU00	—	6AU30	
Float height	mm (in)	20.0–21.0 (0.79–0.83)			
Valve seat size	mm (in)	0.7 (0.03)			
Main jet (M.J.)					
(For Europe)		#86			
(For Oceania)		#90	—	#90	
Main nozzle (M.N.)	mm (in)	2.0 (0.08)			
Pilot jet (P.J.)		#40			
Pilot screw (P.S.)					
(For Europe)	turns out	1 5/8			
(For Oceania)	turns out	1 5/8	—	1 5/8	
Engine idle speed	r/min	1,050 ± 50			

Item	Unit	Model			
		Pike 9.9			
Fuel pump					
Fuel pump holding pressure					
Fuel inlet positive pressure	kPa (kgf/cm^2, psi)	50 (0.5, 7.3)			
Fuel inlet negative pressure	kPa (kgf/cm^2, psi)	30 (0.3, 4.4)			
Fuel outlet positive pressure	kPa (kgf/cm^2, psi)	50 (0.5, 7.3)			
Fuel joint holding pressure					
Positive pressure	kPa (kgf/cm^2, psi)	50 (0.5, 7.3)			
Fuel filter assembly holding pressure					
Positive pressure	kPa (kgf/cm^2, psi)	200 (2.0, 29.0)			

Lower unit

Item	Unit	Model			
		Pike 9.9			
Lower unit					
Holding pressure	kPa (kgf/cm^2, psi)	100 (1.0, 14)			
Gear backlash					
Pinion-to-forward gear(*1)	mm (in)	0.50–2.27 (0.0197–0.0894)	0.76–2.30 (0.0299–0.0906)		
Pinion-to-reverse gear(*1)	mm (in)	0.50–2.27 (0.0197–0.0894)	0.76–2.30 (0.0299–0.0906)		
Pinion shims	mm	1.9, 2.0, 2.1, 2.2	1.13, 1.20		
Forward gear shims	mm	0.10, 0.12, 0.15, 0.18, 0.30	0.1, 0.2, 0.3, 0.4		
Reverse gear shims	mm	0.1	0.1, 0.2, 0.3		
Propeller shaft					
Runout limit	mm (in)	0.05 (0.0020)	0.02 (0.0008)		

(*1) Figures obtained using the special service tools.

Item	Unit	Model			
		Pike 9.9			
Drive shaft					
Runout limit	mm (in)	1.0 (0.0394)	0.5 (0.0197)		

Electrical

Item	Unit	Model			
		Pike 9.9			
Ignition and ignition control system					
Spark plug gap	mm (in)	0.9–1.0 (0.035–0.039)			
Spark plug cap resistance(*1)	kΩ	4.0–6.0			
Ignition coil resistance(*1)					
Primary coil (O – B)					
at 20 °C (68 °F)	Ω	0.26–0.35			
Secondary coil (spark plug wire – spark plug wire)					
at 20 °C (68 °F)	kΩ	6.8–10.2			
Pulser coil output peak voltage (W/R – B)					
at cranking (unloaded)	V	7.0			
at cranking (loaded)	V	3.5			
at 1,500 r/min (loaded)	V	7.0			
at 3,500 r/min (loaded)	V	10.5			
Pulser coil resistance(*1) (W/R – B)					
at 20 °C (68 °F)	Ω	240–360			
Charge coil output peak voltage (Br – L)					
at cranking (unloaded)	V	140			
at cranking (loaded)	V	160			
at 1,500 r/min (loaded)	V	180			
at 3,500 r/min (loaded)	V	180			
Charge coil resistance(*1) (Br – L)					
at 20 °C (68 °F)	Ω	232–348			
CDI unit output peak voltage(*1) (O – B)					
at cranking (loaded)	V	140			
at 1,500 r/min (loaded)	V	170			
at 3,500 r/min (loaded)	V	170			

(*1) The figures are for reference only.

Item	Unit	Model			
		Pike 9.9			
Oil pressure switch					
Specified oil pressure	kPa (kgf/cm^2, psi)	14.7 (0.147, 2.132)			
Fuel control system					
Choke solenoid resistance(*1) (L – B)					
at 20 °C (68 °F)	Ω	—			
Starter motor					
Type		—			
Output	kW	—			
Cranking time limit	Second	—			
Stator motor clearance	mm (in)	—			
Wear limit	mm (in)	—			
Brushes					
Standard length	mm (in)	—			
Wear limit	mm (in)	—			
Commutator					
Standard diameter	mm (in)	—			
Wear limit	mm (in)	—			
Standard undercut	mm (in)	—			
Wear limit	mm (in)	—			
Pinion stopper height	mm (in)	—			
Charging system					
Fuse	A	10			
Lighting coil (1 coil) output peak voltage (G – G)					
at cranking (unloaded)	V	6.1			
at 1,500 r/min (unloaded)	V	14.6			
at 3,500 r/min (unloaded)	V	33.1			
Lighting coil (1 coil) resistance(*1) (G – G)					
at 20 °C (68 °F)	Ω	0.24–0.36			
Lighting coil (2 coils) output peak voltage (G/W – G)					
at cranking (unloaded)	V	16.1			
at 1,500 r/min (unloaded)	V	33.3			
at 3,500 r/min (unloaded)	V	79.1			
Lighting coil (2 coils) resistance(*1) (G/W – G)					
at 20 °C (68 °F)	Ω	0.61–0.91			

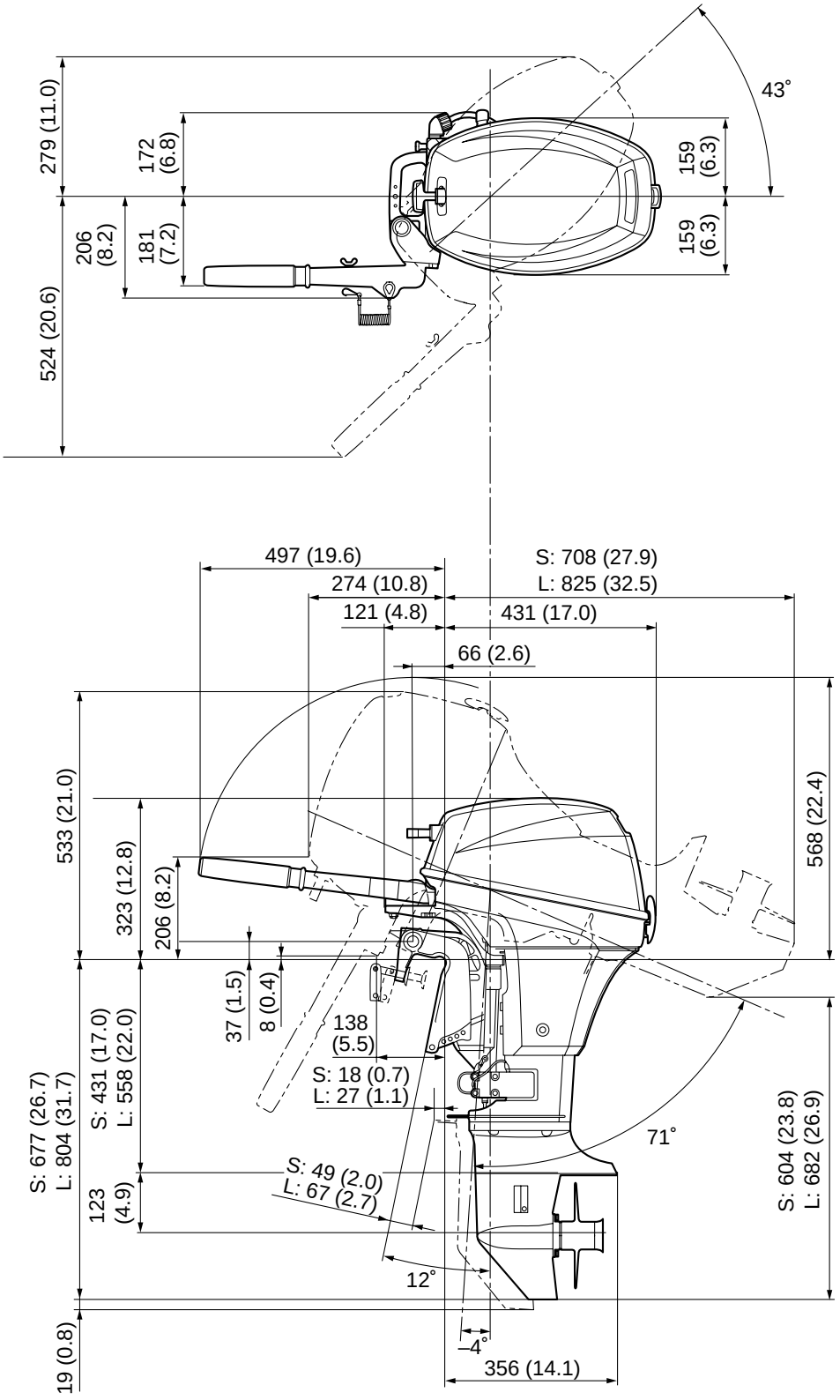
(*1) The figures are for reference only.

Item	Unit	Model			
		Pike 9.9			
Rectifier output peak voltage (R – Ground)					
at 1,500 r/min (unloaded)	V	13		—	
at 3,500 r/min (unloaded)	V	19		—	
Rectifier Regulator output peak voltage (R – Ground)					
at 1,500 r/min (loaded)	V	13			
at 3,500 r/min (loaded)	V	13			
PT motor					
Output	kW	—			0.18
Brushes					
Standard length	mm (in)	—			6.0 (0.24)
Wear limit	mm (in)	—			3.0 (0.12)
Commutator					
Standard diameter	mm (in)	—			16.5 (0.65)
Wear limit	mm (in)	—			15.5 (0.61)
Standard undercut	mm (in)	—			1.00 (0.039)
Wear limit	mm (in)	—			0.50 (0.020)

Dimension

Exterior Pike 9.9 M

mim (in)



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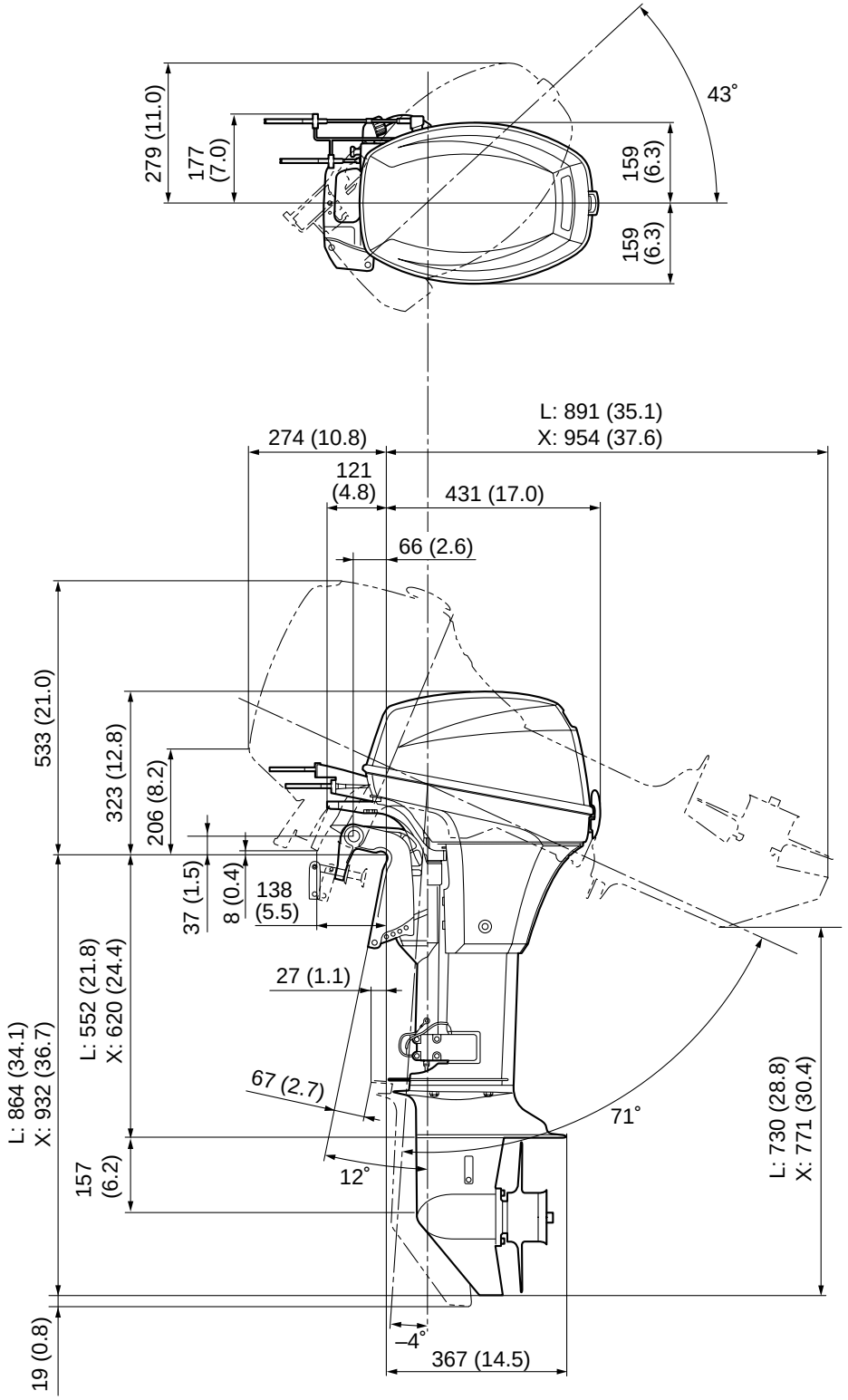
Exterior Pike 9.9 E

mim (in)



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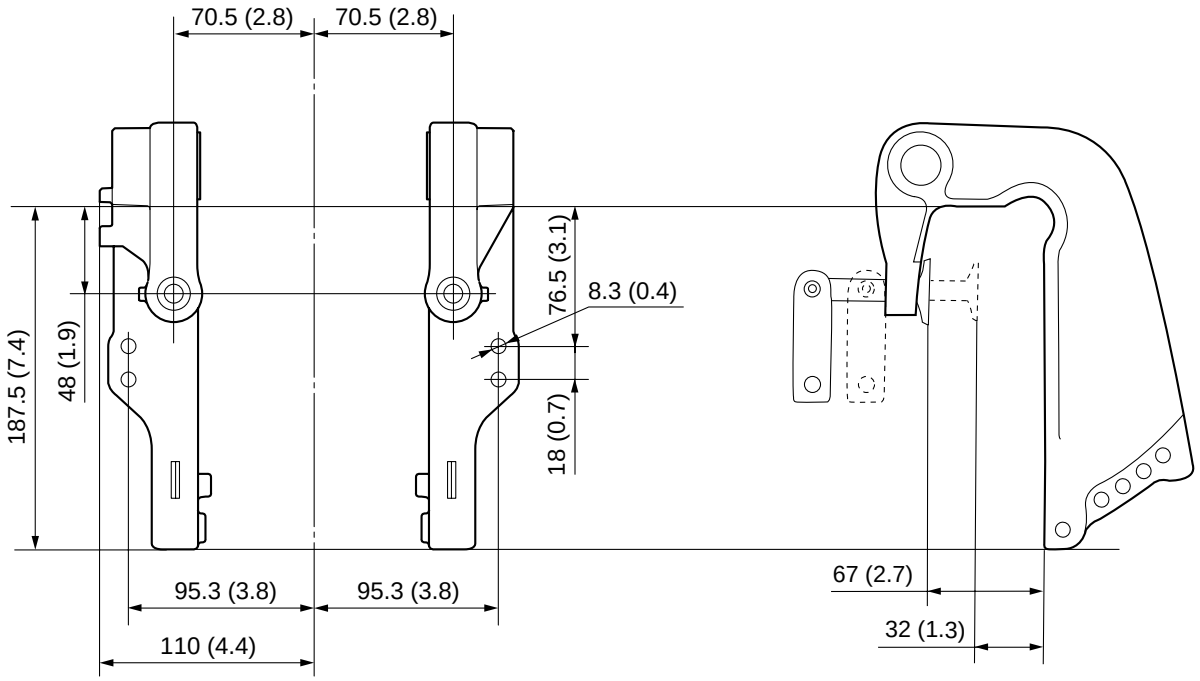
Clamp bracket



Tightening torque

Specified torque

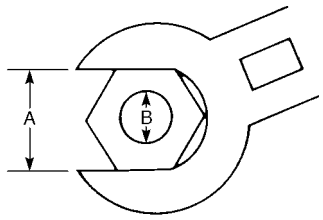
Part to be tightened		Thread size	Tightening torques		
			N·m	kgf·m	ft·lb
Fuel system					
Fuel joint bolt		M6	8	0.8	5.9
Fuel pump screw		M4	2	0.2	1.5
Fuel pump valve screw		M3	0.5	0.05	0.37
Power unit					
Drive plate screw (M model)		M5	5	0.5	3.7
Power unit mounting bolt		M8	21	2.1	15.5
Apron screw		M6	2.5	0.25	1.84
Ignition coil bolt		M6	8	0.8	5.9
Ignition coil bracket bolt (1 lighting coil)		M8	18	1.8	13.3
Rectifier screw (1 lighting coil)		M5	3.5	0.35	2.6
Rectifier Regulator bolt (2 lighting coils)		M6	8	0.8	5.9
Spark plug		—	24	2.4	17.7
Pulser coil bolt		M5	5	0.5	3.7
CDI unit bolt		M6	8	0.8	5.9
Starter motor bolt (E model)		M8	21	2.1	15.5
Negative battery cable bolt (E model)		M8	18	1.8	13.3
Charge coil bolt		M6	12	1.2	8.9
Starter motor lead nut (E model)		—	4	0.4	3.0
Starter motor terminal nut (E model)		—	0.4	0.04	0.30
Starter relay lead bolt (E model)		M6	4	0.4	3.0
Starter motor bracket bolt (E model)		M8	21	2.1	15.5
Oil pressure switch		—	8	0.8	5.9
Oil pressure switch lead bolt		—	2	0.2	1.5
Throttle cam bolt		M6	8	0.8	5.9
Throttle cable bracket bolt		M6	8	0.8	5.9
Flywheel magnet nut		—	98	9.8	72.3
Drive sprocket nut		—	36	3.6	26.6
Driven sprocket bolt		M6	12	1.2	8.9
Intake manifold bolt	1st	M6	6	0.6	4.4
	2nd		12	1.2	8.9
Cylinder head cover bolt		M6	8	0.8	5.9
Blowby plate screw		M4	2	0.2	1.5
Cylinder head bolt	1st	M8	15	1.5	11.1
	2nd		29	2.9	21.4
	1st	M6	6	0.6	4.4
	2nd		12	1.2	8.9
Anode plug		—	18	1.8	13.3
Rocker arm locknut		—	7	0.7	5.2
Oil pump assembly bolt		M6	8	0.8	5.9
Oil pump screw		M6	5	0.5	3.7

Part to be tightened		Thread size	Tightening torques		
			N·m	kgf·m	ft·lb
Anode screw		M5	2	0.2	1.5
Thermostat cover bolt		M6	8	0.8	5.9
Relief valve		—	8	0.8	5.9
Exhaust cover bolt	1st	M6	6	0.6	4.4
	2nd		12	1.2	8.9
Crankcase bolt	1st	M8	15	1.5	11.1
	2nd		30	3.0	22.1
Connecting rod cap bolt	1st	M7	6	0.6	4.4
	2nd		11	1.1	8.1
Lower unit					
Gear oil drain screw		—	9	0.9	6.6
Gear oil check screw		—	9	0.9	6.6
Lower case mounting bolt		M8	18	1.8	13.3
Lower case mounting nut (X-transom model)		—	18	1.8	13.3
Propeller nut		—	17	1.7	12.5
Propeller nut (high thrust model)		—	21	2.1	15.5
Cooling water inlet cover screw		M5	2	0.2	1.5
Anode bolt		M6	8	0.8	5.9
Water pump housing bolt		M8	18	1.8	13.3
Propeller shaft housing bolt		M6	8	0.8	5.9
Pinion nut (high thrust model)		—	25	2.5	18.4
Bracket unit					
Shift lever bolt (H model [short]/R model)		M5	3	0.3	2.2
Shift lever bolt (H model [long])		M8	18	1.8	13.3
Shift lever screw (H model [long])		M6	3	0.3	2.2
Tiller handle bracket nut (H model)		—	36	3.6	26.6
Tiller handle assembly nut (H model [short])		—	22	2.2	16.2
Tiller handle assembly nut (H model [long])		—	10	1.0	7.4
Tiller handle assembly self-locking nut (H model [long])		—	22	2.2	16.2
Throttle grip screw (H model)		M5	3	0.3	2.2
PT switch screw (PT model)		M6	6	0.6	4.4
PT switch bracket screw (PT model)		M6	4	0.4	3.0
Engine shut-off switch nut (H model)		—	2	0.2	1.5
Friction plate assembly bolt (H model)		M5	7	0.7	5.2
Friction plate bolt (H model)		M5	7	0.7	5.2
Friction plate bolt (H model)		M8	18	1.8	13.3
Friction self-locking nut (H model)		—	6	0.6	4.4
Flushing hose adapter screw		M6	2	0.2	1.5
Cowling lock lever bolt		M6	8	0.8	5.9
Upper mounting nut		—	20	2.0	14.8
Mount housing nut	1st	—	7	0.7	5.2
	2nd		12	1.2	8.9
	3rd		14	1.4	10.3

Part to be tightened	Thread size	Tightening torques		
		N·m	kgf·m	ft·lb
Upper mount bolt	M6	11	1.1	8.1
Engine oil drain bolt	—	24	2.4	17.7
Oil pan bolt	M8	21	2.1	15.5
Exhaust manifold bolt	M6	11	1.1	8.1
Upper case bolt	M8	18	1.8	13.3
Shift rod grommet plate bolt	M6	8	0.8	5.9
Self-locking nut	—	19	1.9	14.0
Tilt stopper plate bolt (MT model)	—	8	0.8	5.9
Anode bolt (PT model)	M6	8	0.8	5.9
Stopper nut (PT model)	—	24	2.4	17.7
Ground lead bolt (PT model)	M6	8	0.8	5.9
PT unit mounting shaft bolt (PT model)	M8	18	1.8	13.3
Grease nipple	—	3	0.3	2.2
PT unit (PT model)				
PT motor assembly bolt	M5	5	0.5	3.7
Reservoir cap	—	5	0.5	3.7
Gear housing bolt	M5	5	0.5	3.7
Tilt cylinder end screw	—	45	4.5	33.2
Tilt ram	—	45	4.5	33.2

General torque

This chart specifies tightening torques for standard fasteners with a standard ISO thread pitch. Tightening torque specifications for special components or assemblies are provided in applicable sections of this manual. To avoid warpage, tighten multi-fastener assemblies in a crisscross fashion and progressive stages until the specified torque is reached. Unless otherwise specified, torque specifications require clean, dry threads.
Components should be at room temperature.



S69J2150

Nut (A)	Bolt (B)	General torque specifications		
		N·m	kgf·m	ft·lb
8 mm	M5	5	0.5	3.7
10 mm	M6	8	0.8	5.9
12 mm	M8	18	1.8	13.3
14 mm	M10	36	3.6	26.6
17 mm	M12	43	4.3	31.7

CHK
ADJ

Periodic check and adjustment

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3

Maintenance interval chart

Use the following chart as a guideline for general maintenance.
Adjust the maintenance intervals according to the operating conditions of the outboard motor.

Item	Remarks	Initial	Every			Refer to page
		20 hours (3 months)	100 hours (1 year)	300 hours (3 years)	500 hours (5 years)	
Anode(s) (external)	Check/replace		○			3-16
Anode(s) (cylinder head, thermostat cover)	Check/replace		○			3-16
Battery	Check/charge/ replace	○	○			3-16
Cooling water leakage	Check/replace	○	○			3-7
Cowling clamp	Check		○			3-3
Engine starting condition/ noise	Check	○	○			—
Engine idle speed/noise	Check	○	○			3-11
Engine oil	Replace	○	○			3-4
Engine oil filter (built into oil pan)	Check/clean/ replace		○			7-22
Fuel filter	Replace		○			3-3
Fuel pump	Check/replace			○		4-4
Fuel/oil leakage	Check	○	○			3-3
Fuel pipe	Check/replace	○	○			3-3
Fuel pipe	Replace			○		4-1
Gear oil	Replace	○	○			3-14
Greasing points	Lubricate	○	○			3-17
Impeller/water pump housing	Check/replace		○			6-5, 6-25
Impeller/water pump housing	Replace			○		6-5, 6-25
PT unit	Check	○	○			3-13
Propeller/propeller nut/cotter pin	Check/replace	○	○			6-1, 6-21
Shift link/shift cable	Check/adjust/ replace	○	○			3-10
Spark plug(s)	Check/adjust/ replace		○			3-5
Spark plug caps/spark plug wires	Check/replace	○	○			8-30
Pilot water	Check	○	○			3-7
Throttle link/throttle cable/ throttle pick-up timing	Check/adjust/ replace	○	○			3-7, 3-8, 3-9
Thermostat	Check/replace		○			3-6
Timing belt	Check/ replace(*1)		○			3-5
Valve clearance	Check/adjust				○	5-1
Water inlet	Check	○	○			3-7

(*1) Check and, if defective, replace.

Item	Remarks	Initial	Every			Refer to page
		20 hours (3 months)	100 hours (1 year)	300 hours (3 years)	500 hours (5 years)	
Main switch/stop switch/choke switch	Check/replace	○	○			8-26, 8-27, 8-33
Wire harness connections/ wire coupler connections	Check/replace	○	○			8-1
(Selva) Fuel tank	Check/clean		○			

NOTE:

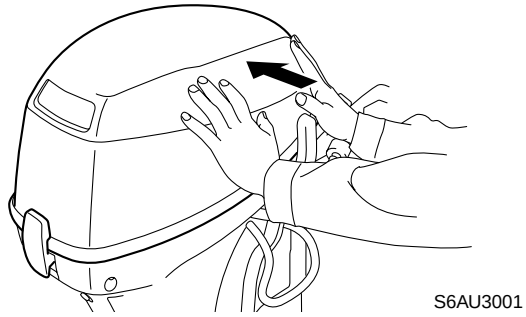
- When operating in salt water, turbid or muddy water, the engine should be flushed with clean water after each use.
- When using leaded or high-sulfur gasoline, checking the valve clearances may be required more frequently than every 500 hours.

Item	Remarks	Every	Refer to page
		1,000 hours	
Exhaust guide/exhaust manifold	Check/replace	○	7-22
Timing belt	Replace	○	5-3

Top cowling

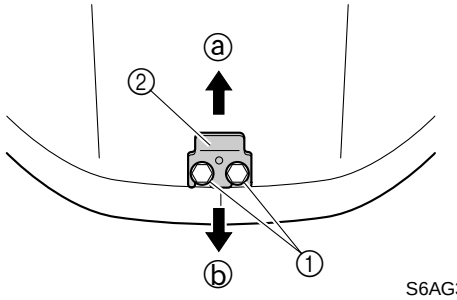
Checking the top cowling

1. Check the fitting by pushing the cowling with both hands. Adjust if necessary.


S6AU3001

2. Loosen the bolts ①.

3. Move the hook ② up or down slightly to adjust its position.



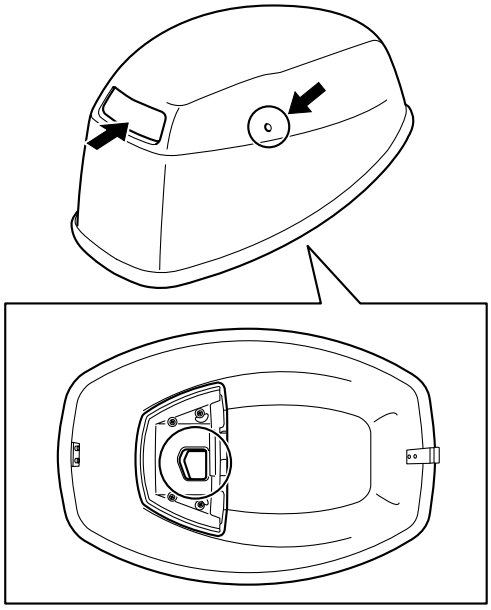
S6AG3020

NOTE:
- To tighten the fitting, move the hook ② in direction ⓐ.
- To loosen the fitting, move the hook ② in direction ⓑ.

4. Tighten the bolts ①.

5. Check the fitting again and, if necessary, repeat steps 2–4.

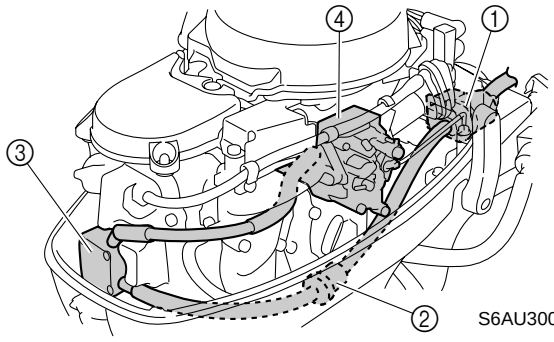
6. Check the air intake duct. Clean if there are obstructions.


S6AU3003

Fuel system

Checking the fuel joint and fuel hose (fuel joint-to-carburetor)

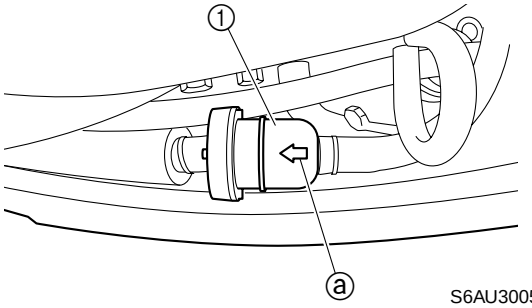
1. Check the fuel hose connections for leaks. Also, check the fuel joint ①, fuel hoses, fuel filter ②, fuel pump ③, and carburetor ④. Replace if there is leakage or deterioration.



S6AU3004

Checking the fuel filter

1. Check the fuel filter ①. Replace if there is residue or if it is cracked or damaged.



S6AU3005

CAUTION:

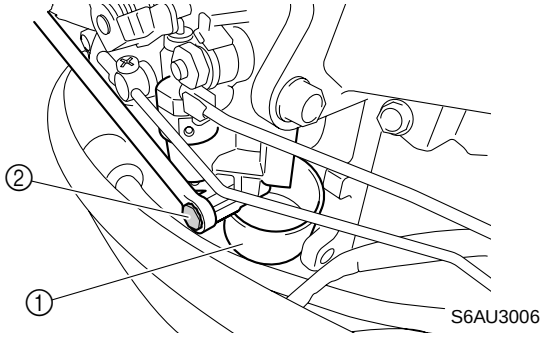
When replacing the fuel filter ①, the arrow mark ⓐ must face toward the fuel pump.

NOTE:

Be sure not to spill any fuel when removing the fuel filter ①.

Draining the fuel

1. Place a container ① or rag under the carburetor fuel drain hole, and then remove the fuel drain screw ② and let the fuel drain completely.



S6AU3006

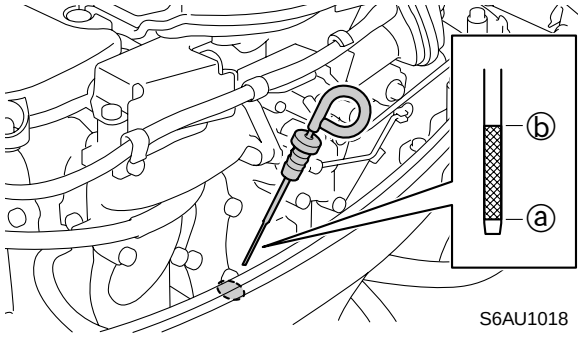
Power unit

Checking the engine oil

1. Place the outboard motor in an upright position.

2. Remove the oil dipstick, wipe it clean, and then insert it back into the oil dipstick hole.

3. Remove the oil dipstick again to check the oil level and to check the oil for discoloration and its viscosity.



S6AU1018

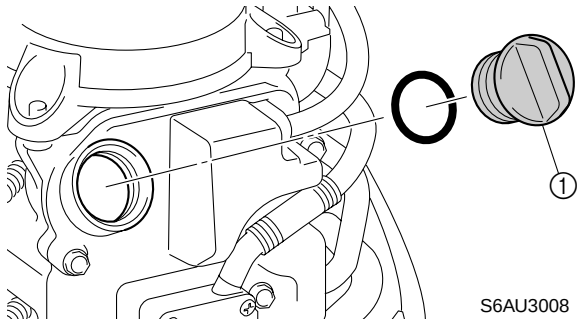
NOTE:

- If the oil appears milky or dirty, check for and repair the cause, and then change the oil.
- If the engine oil is below the minimum level mark ⓐ, add sufficient oil until the level is between ⓐ and ⓑ.

Changing the engine oil

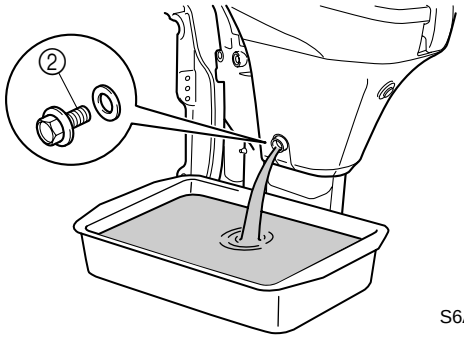
1. Start the engine, warm it up, and then turn it off.

2. Remove the oil dipstick and oil filler cap ①.



S6AU3008

3. Place a drain pan under the drain hole, and then remove the engine oil drain bolt ② and let the oil drain completely.



S6AU3009

NOTE:
- Be sure to clean up any oil spills.
- When using an oil changer to change the engine oil, insert the oil changer hose into the oil dipstick hole.

4. Install the engine oil drain bolt ②, and then tighten it to the specified torque.

Engine oil drain bolt ②:
24 N·m (2.4 kgf·m, 17.7 ft·lb)

5. Pour the specified amount of the recommended engine oil into the oil filler hole.

Recommended engine oil:
4-stroke motor oil
API: SE, SF, SG, SH, SJ, or SL
SAE: 5W-30, 10W-30, or 10W-40
Engine oil quantity:
0.8 L (0.85 US qt, 0.70 Imp qt)

6. Install the oil filler cap and oil dipstick, and then start the engine and warm it up.

7. Turn the engine off, and then check the oil level and that there is no oil leakage. If the oil level is low, add engine oil to the correct level.

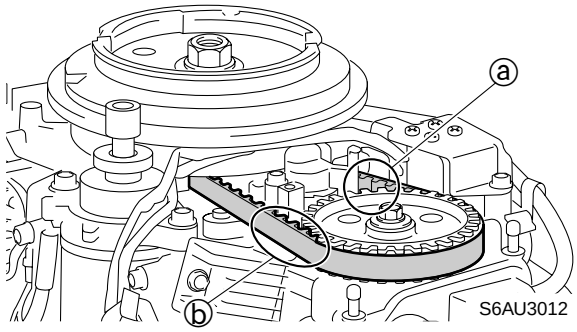
Checking the timing belt

CAUTION:

Do not turn the flywheel magnet counterclockwise, otherwise the water pump impeller may be damaged.

1. Remove the driven sprocket cover and manual starter. (M model)
   Remove the driven sprocket cover and flywheel magnet cover. (E model)

2. While turning the flywheel magnet clockwise, check the interior ⓐ and the exterior ⓑ of the timing belt. Replace the timing belt if cracked, damaged, or worn.



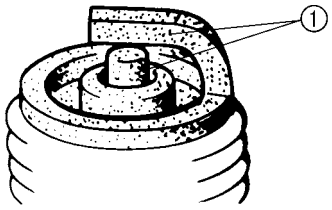
S6AU3012

NOTE:
To replace the timing belt, see “Replacing the timing belt” (5-3).

Checking the spark plug

1. Disconnect the spark plug caps and remove the spark plugs.

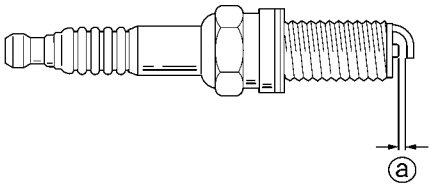
2. Clean the electrodes ① with a spark plug cleaner or wire brush.



S69J3190

3. Check the spark plug. Replace if the electrodes are eroded or there is excessive carbon or other deposits, or if the gasket is damaged.

4. Check the spark plug gap ⓐ. Adjust the spark plug gap if out of specification.



S69J3200

NOTE:
Perform steps 2–4 for each spark plug.

Specified spark plug:
BR6HS-10 (NGK)
Spark plug gap ⓐ:
0.9–1.0 mm (0.035–0.039 in)

5. Install the spark plugs, tighten them temporarily, and then tighten them to the specified torque using a spark plug wrench.

Spark plug:
24 N·m (2.4 kgf·m, 17.7 ft·lb)

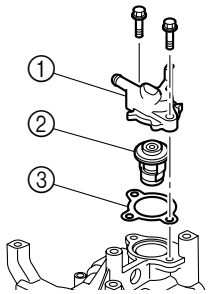
6. Connect the spark plug caps.

Checking the thermostat

1. Remove the driven sprocket cover and manual starter. (M model)
   Remove the driven sprocket cover and flywheel magnet cover. (E model)

2. Disconnect the cooling water hose.

3. Remove the thermostat cover ① and thermostat ②.

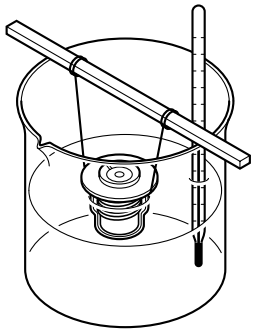


S6AU3015

CAUTION:
Do not reuse the gasket ③, always replace it with a new one.

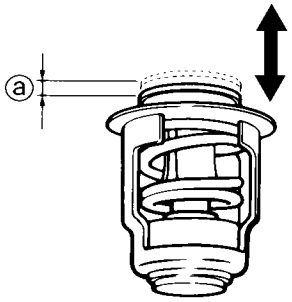
4. Suspend the thermostat in a container of water.

5. Place a thermometer in the water and slowly heat the water.



S69J5E40

6. Measure the thermostat valve opening ⓐ at the specified water temperatures. Replace the thermostat if out of specification.



S6AL3100

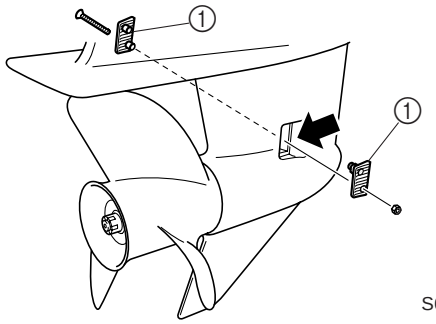
Water temperature	Valve opening ⓐ
58–62 °C (136–144 °F)	0.05 mm (0.0020 in) (valve begins to open)
Above 70 °C (158 °F)	More than 3.0 mm (0.12 in)

7. Install a new gasket, the thermostat, and the thermostat cover, and then tighten the thermostat cover bolts to the specified torque.

Thermostat cover bolt:
8 N·m (0.8 kgf·m, 5.9 ft·lb)

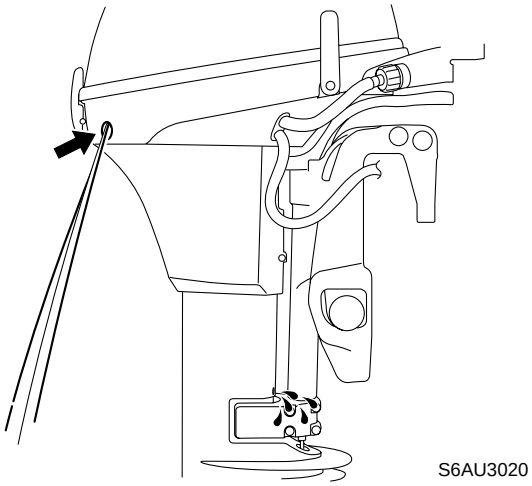
Checking the cooling water passage

1. Check the cooling water inlet covers ① and cooling water inlets. Clean if clogged.



S6D53130

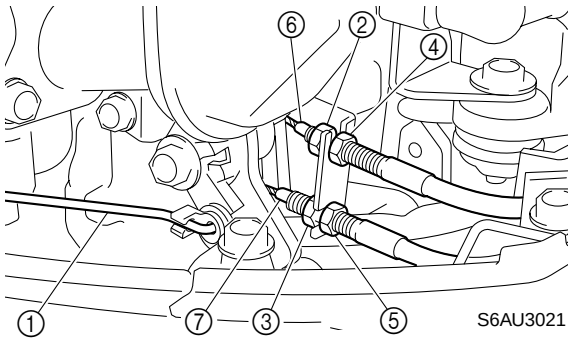
2. Place the lower unit in water, and then start the engine.
3. Check for water flow at the cooling water pilot hole. If there is no water flow, check the cooling water passages inside the outbound motor.


S6AU3020

Control system

Adjusting the throttle cable (H model)

1. Disconnect the throttle link rod ① from the free accel lever.
2. Loosen the locknuts ② and ③, and then turn the adjusting nuts ④ and ⑤ to loosen the throttle cables ⑥ and ⑦.

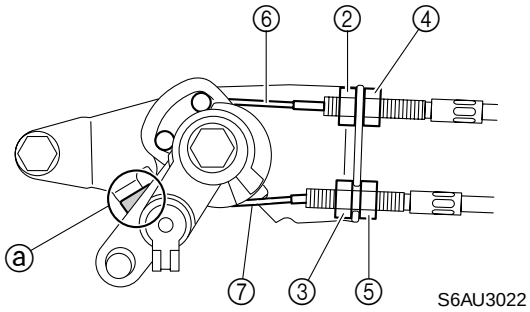


S6AU3021

3. Turn the throttle grip to the fully open position and hold it in place.
4. Turn the adjusting nut ④ so that the fully open stopper ⓐ on the throttle cam contacts the throttle cable bracket as shown, and then tighten the locknut ②.

NOTE:
Be careful not to pull the outer cables too much towards the power unit as they could be pulled out of the holes in the pivot section of the tiller handle. If the outer cables are pulled out of the tiller handle, see “Installing the tiller handle” (7-3) or “Installing the tiller handle” (7-8).

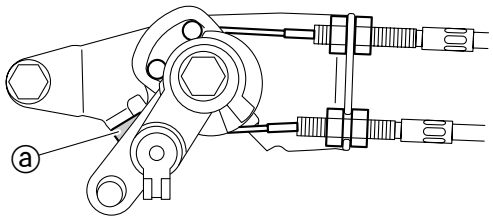
5. Turn the adjusting nut ⑤ to remove the slack in the throttle cable ⑦, and then tighten the locknut ③.



S6AU3022

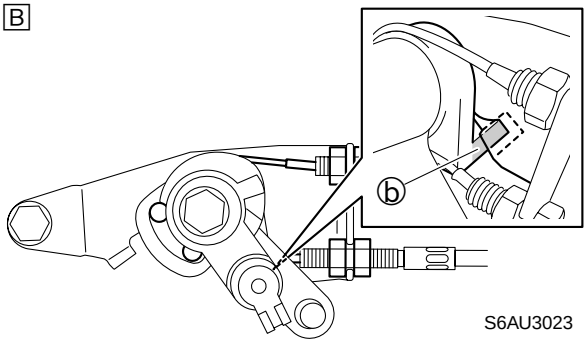
6. Turn the throttle grip to the fully open and fully closed positions and check that the fully open stopper ⓐ and fully closed stopper ⓑ on the throttle cam contact the throttle cable bracket as shown. Repeat steps 2–5 if necessary.

A



S6AU3059

B



S6AU3023

A Fully open position
B Fully closed position

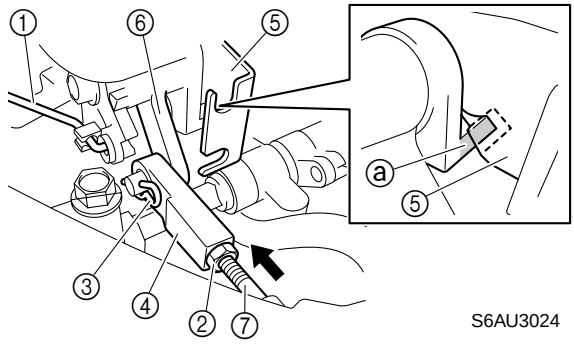
7. Connect the throttle link rod ① to the free accel lever.

NOTE:
After adjusting the throttle cables, adjust the throttle link.

Adjusting the throttle cable (R model)

1. Disconnect the throttle link rod ① from the free accel lever.

2. Loosen the locknut ②, remove the clip ③, and then disconnect the throttle cable joint ④.

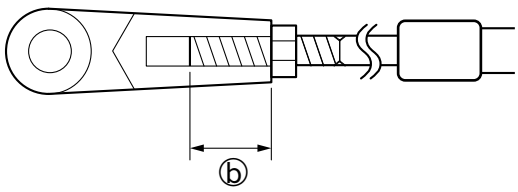


S6AU3024

3. Set the remote control lever to the N position.

4. Check that the fully closed stopper ⓐ on the throttle cam contacts the throttle cable bracket ⑤.

5. Adjust the position of the throttle cable joint ④ until its hole is aligned with the set pin on the throttle cam ⑥.



S6AG1090

⚠ WARNING

The throttle cable joint must be screwed in a minimum of 8.0 mm (0.31 in) ⓑ.

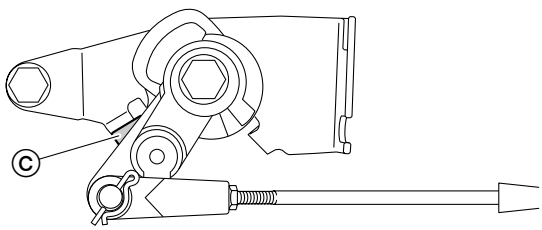
NOTE:

Pull the throttle cable ⑦ towards the engine to remove any free play in the cable before adjusting the position of the throttle cable joint.

6. Connect the throttle cable joint ④, install the clip ③, and then tighten the locknut ②.

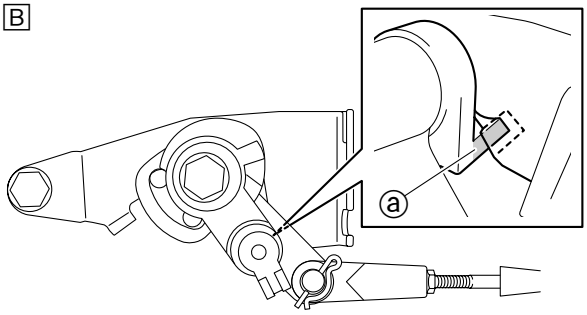
7. Set the remote control lever to the fully open and fully closed positions and check that the fully open stopper ⓒ and fully closed stopper ⓐ on the throttle cam contact the throttle cable bracket as shown.

A



S6AU3060

B



S6AU3026

A Fully open position
B Fully closed position

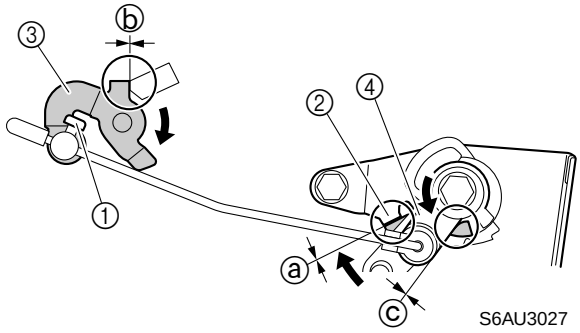
8. Connect the throttle link rod ① to the free accel lever.

NOTE:

After adjusting the throttle cable, adjust the throttle link.

Adjusting the throttle link

1. Loosen the throttle link stopper screw ①.



S6AU3027

2. Turn the throttle grip (H model) or remote control lever (R model) to the fully open position and hold it in place. Check that the fully open stopper ② on the throttle cam contacts the throttle cable bracket ⓐ.

NOTE:

If the fully open stopper ② does not contact the throttle cable bracket ⓐ, adjust the throttle cable(s). See “Adjusting the throttle cable (H model)” (3-7) or “Adjusting the throttle cable (R model)” (3-8).

3. Turn the carburetor throttle lever ③ clockwise so that it contacts the carburetor body ⓑ as shown.

4. Turn the free accel lever ④ counterclockwise until it contacts the throttle cam ⓒ.

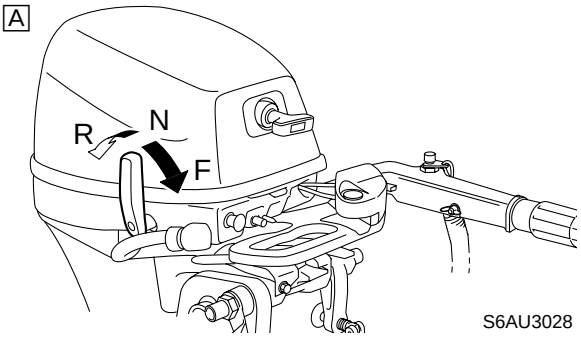
5. Tighten the throttle link stopper screw ①.

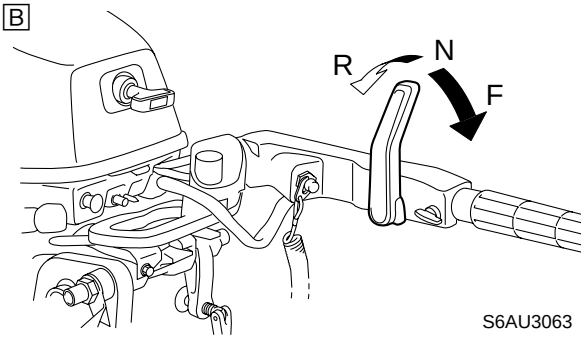
6. Turn the throttle grip (H model) or remote control lever (R model) to the fully open and fully closed positions and check that the throttle cam operates smoothly.

NOTE:
After adjusting the throttle link, adjust the engine idle speed. See "Checking the engine idle speed" (3-11).

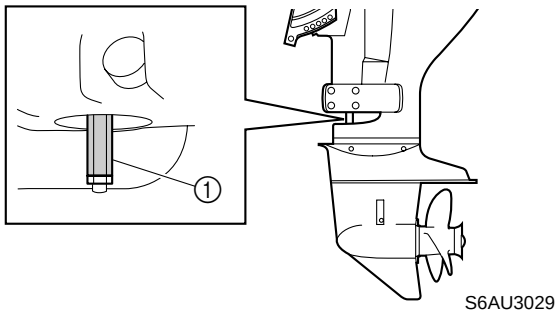
Checking the gear shift operation (H model)

1. Check that the gear shift operates smoothly when the shift lever is shifted from the N position to the F position or R position. Adjust the shift rod adjusting nut ① if necessary.





A H model (short)
B H model (long)



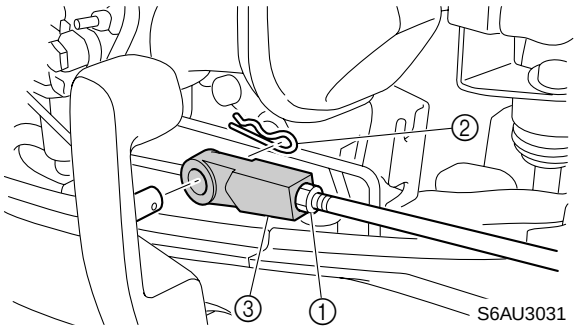
NOTE:
To adjust the shift rod adjusting nut ①, see "Installing the lower unit" (6-15) or "Installing the lower unit" (6-37).

Checking the gear shift operation (R model)

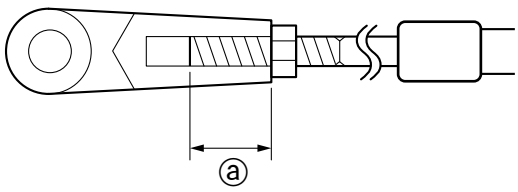
1. Check that the gear shift operates smoothly when the remote control lever is shifted from the N position to the F position or R position. Adjust the shift cable length and shift rod adjusting nut if necessary.

2. Set the remote control lever to the N position.

3. Loosen the locknut ①, remove the clip ②, and then disconnect the shift cable joint ③.



4. Adjust the position of the shift cable joint until its hole is aligned with the set pin on the shift rod lever joint.



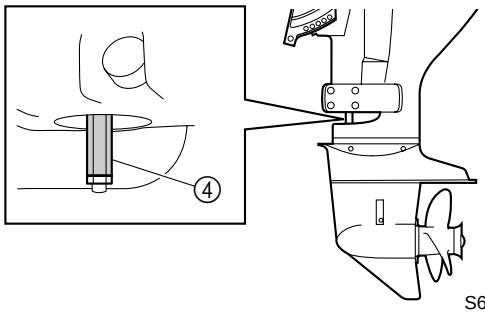
S6AG3130

⚠ WARNING

The shift cable joint must be screwed in a minimum of 8.0 mm (0.31 in) ⓐ.

5. Connect the shift cable joint ③, install the clip ②, and then tighten the locknut ①.

6. Adjust the shift rod adjusting nut ④.



S6AU3033

NOTE:

To adjust the shift rod adjusting nut ④, see "Installing the lower unit" (6-15) or "Installing the lower unit" (6-37).

7. Check the gear shift for smooth operation.

Checking the start-in-gear protection (M model)

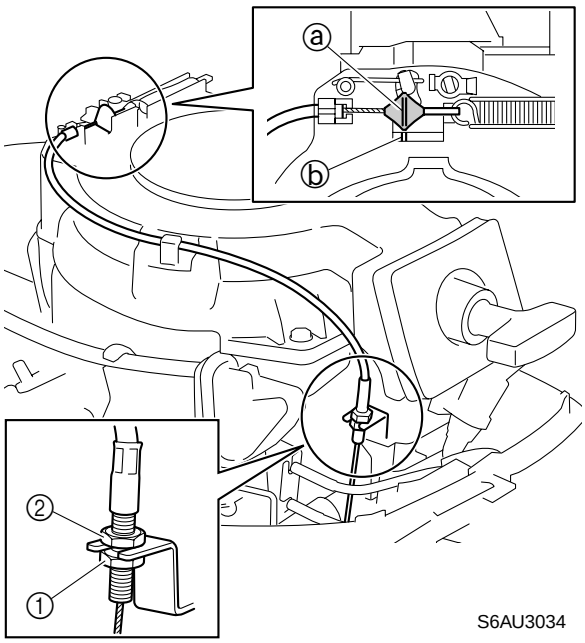
CAUTION:

Be sure to remove the clip from the engine shut-off switch before checking the start-in-gear protection.

1. Set the shift lever to the F position or R position, and then check that the starter handle cannot be pulled. If the starter rope can be pulled out normally, adjust the start-in-gear protection cable.

2. Set the shift lever to the N position and loosen the locknut ①. Align the cable end ⓐ with the mark ⓑ on the manual starter cover by turning the adjusting nut ②.

3. Tighten the locknut ①.

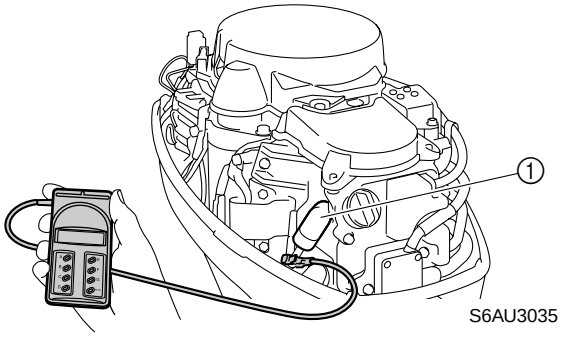


S6AU3034

Checking the engine idle speed

1. Start the engine and warm it up.

2. Attach the special service tool to spark plug wire #1 ①, and then check the engine idle speed. Adjust if out of specification.

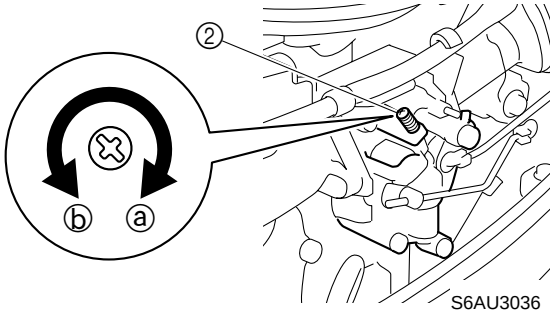


S6AU3035

Digital tachometer: 90890-06760

Engine idle speed: 1,050 ± 50 r/min

3. Turn the throttle stop screw ② in direction ⓐ or ⓑ until the specified engine idle speed is obtained.



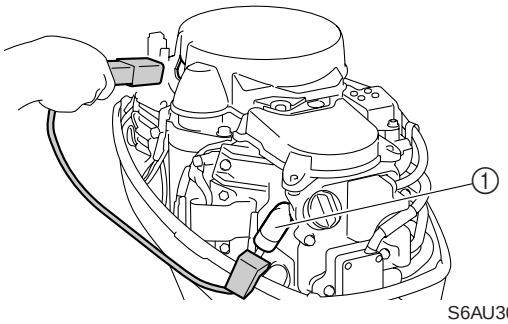
S6AU3036

NOTE:
- To increase the engine idle speed, turn the throttle stop screw ② in direction ⓐ.
- To decrease the engine idle speed, turn the throttle stop screw ② in direction ⓑ.

4. After adjusting the engine idle speed, rev the engine a few times and let it idle to check the stability of the engine.

Checking the ignition timing

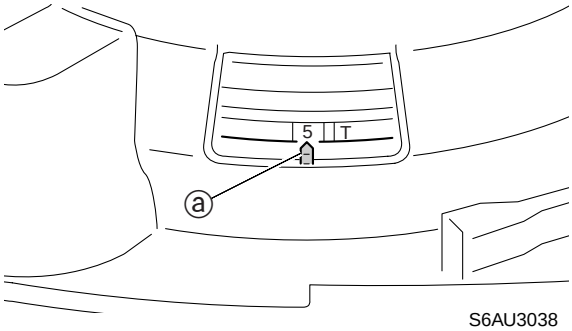
1. Start the engine and warm it up.
2. Attach the special service tool to spark plug wire #1 ①.



S6AU3037

Timing light: 90890-03141

3. Check that the pointer ⓐ is aligned with the "5" mark on the flywheel magnet as shown.



S6AU3038

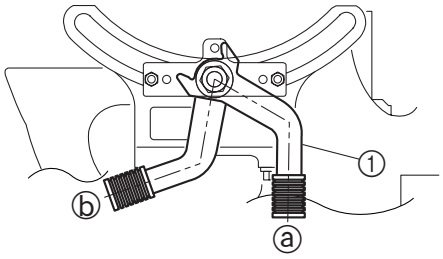
Ignition timing at 1,050 r/min:
BTDC 5 ± 3°

Bracket unit

Checking the steering operation (H model)

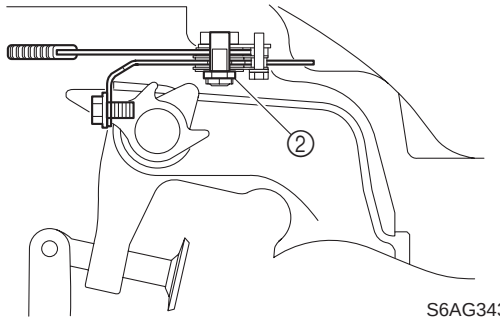
NOTE:
Lubricate the swivel bracket before checking the steering operation.

1. Move the steering lock lever ① to position ⓐ and check that the steering is locked.
   Move the steering lock lever ① to position ⓑ and check that the steering operates smoothly.



S6AU3039

2. Adjust the self-locking nut ② until the steering operation is proper.



S6AG3430

Checking the tilt operation (MT model)

1. Fully tilt the outboard motor up and down a few times and check the entire tilt range for smooth operation. Check the tilt mechanism if necessary.

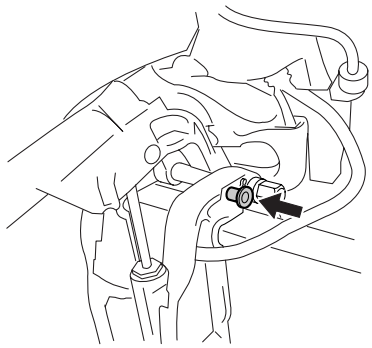
NOTE:
To check the tilt operation, see "Checking the tilt system (MT model)" (1-17).

Checking the tilt operation (PT model)

1. Fully tilt the outboard motor up and down a few times and check the entire tilt range for smooth operation. Check the PT fluid level if necessary.

NOTE:
- To check the PT fluid level, see "Checking the PT fluid level" (3-13).
- Be sure to listen to the winding sound of the PT motor for smooth operation.

2. Fully tilt the outboard motor up, and then support it with the tilt stop lever to check the lock mechanism of the lever.


S6AG3220

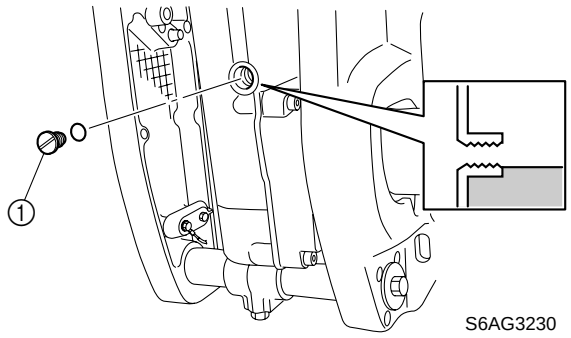
Checking the PT fluid level

1. Fully tilt the outboard motor up, and then support it with the tilt stop lever.

⚠ WARNING

After tilting up the outboard motor, be sure to support it with the tilt stop lever. Otherwise, the outboard motor could suddenly lower if the PT unit should lose fluid pressure.

2. Remove the reservoir cap ①, and then check the fluid level in the reservoir.



S6AG3230

NOTE:
If the fluid is at the correct level, a small amount of fluid should overflow out of the filler hole when the cap is removed.

3. If necessary, add sufficient fluid of the recommended type until it overflows out of the filler hole.

Recommended PT fluid:
ATF Dexron II

4. Install a new O-ring and the reservoir cap ①, and then tighten the cap to the specified torque.

Reservoir cap ①:
5 N·m (0.5 kgf·m, 3.7 ft·lb)

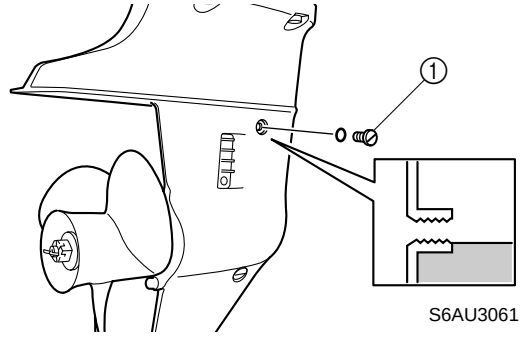
Lower unit

Checking the gear oil

1. Fully tilt the outboard motor down.

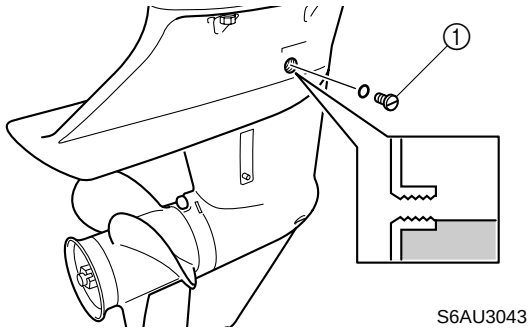
2. Remove the gear oil check screw ①, and then check the gear oil level in the lower case. Also, check the oil for discoloration and its viscosity.

A



S6AU3061

B



S6AU3043

A Except for high thrust model
B For high thrust model

NOTE:

- If the oil is at the correct level, a small amount of oil should overflow out of the check hole when the gear oil check screw ① is removed.
- If the oil appears milky or dirty, check for and repair the cause, and then change the oil.

3. If necessary, add sufficient gear oil of the recommended type until it overflows out of the check hole.

Recommended gear oil:
Hypoid gear oil
API: GL-4
SAE: 90

4. Install a new gasket and the gear oil check screw ①, and then tighten the gear oil check screw to the specified torque.

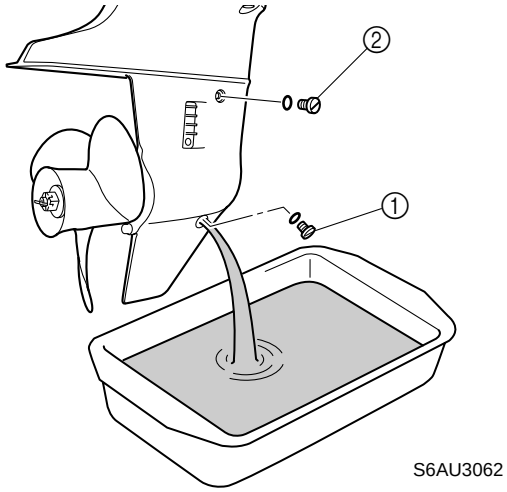
Gear oil check screw ①:
9 N·m (0.9 kgf·m, 6.6 ft·lb)

Changing the gear oil

1. Fully tilt the outboard motor down.

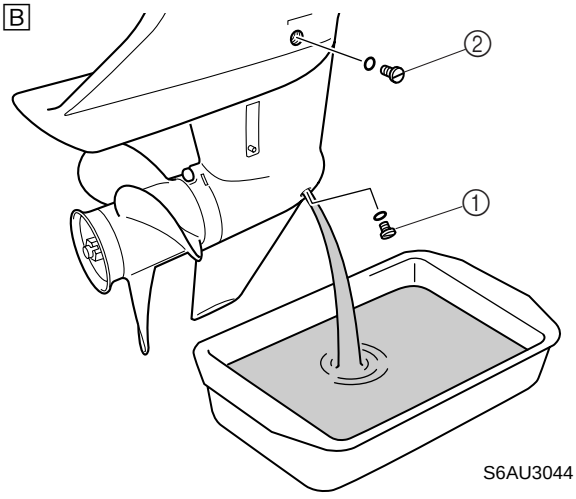
2. Place a drain pan under the gear oil drain hole, remove the gear oil drain screw ①, then the gear oil check screw ②, and let the oil drain completely.

A



S6AU3062

B

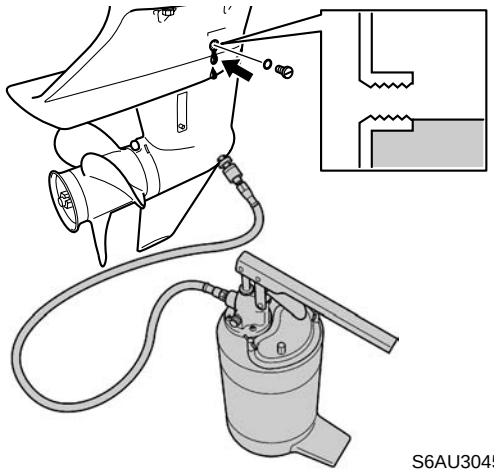


S6AU3044

A Except for high thrust model
B For high thrust model

3. Check the oil for metal and discoloration, and its viscosity. Check the internal parts of the lower case if necessary.

4. Insert a gear oil tube or gear oil pump into the drain hole and slowly fill with gear oil until oil flows out of the check hole and no air bubbles are visible.


S6AU3045

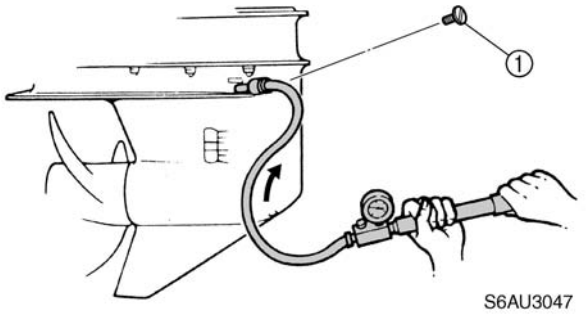
Recommended gear oil:
Hypoid gear oil
API: GL-4
SAE: 90
Gear oil quantity:
Except for high thrust model:
150 cm^3
(5.07 US oz, 5.29 Imp oz)
For high thrust model:
370 cm^3
(12.51 US oz, 13.05 Imp oz)

5. Install new gaskets and the gear oil check screw ②, quickly install the gear oil drain screw ①, and then tighten them to the specified torque.

Gear oil check screw ② and drain screw ①: 9 N·m (0.9 kgf·m, 6.6 ft·lb)

Checking the lower unit for air leakage

1. Remove the gear oil check screw ①, and then install the special service tool.



S6AU3047

Leakage tester: 90890-06840

2. Apply the specified pressure and check that the pressure is maintained in the lower unit for at least 10 seconds.

CAUTION:
Do not overpressurize the lower unit, otherwise the oil seals can be damaged.

NOTE:
Cover the check hole with a rag when removing the special service tool from the lower unit.

Lower unit holding pressure:
100 kPa (1.0 kgf/cm^2, 14 psi)

3. If the specified pressure cannot be maintained, check the propeller shaft, drive shaft, shift rod, O-rings, and oil seals for damage. If necessary, check each shaft for bends and damage.

Checking the propeller

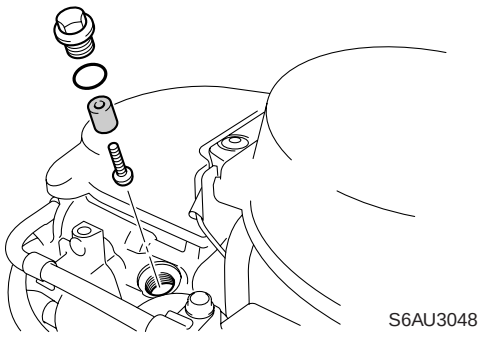
1. Check the propeller blades and splines. Replace the propeller if cracked, damaged, or worn.

NOTE:
When replacing the propeller, see “Propeller selection” (1-12) and select a propeller of the same size as originally installed.

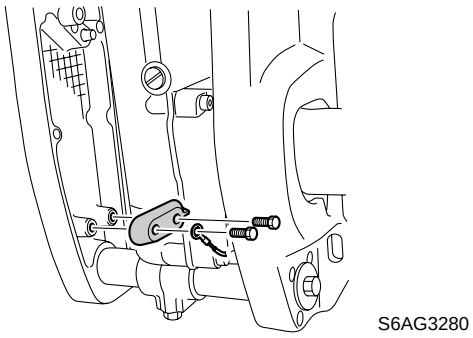
General

Checking the anode

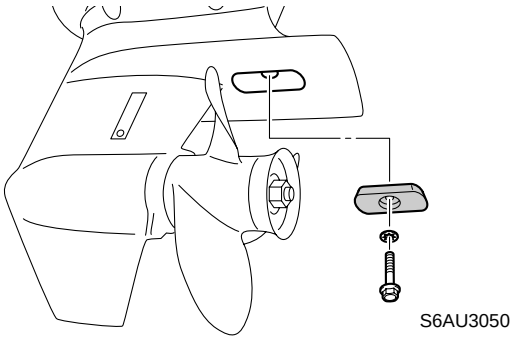
1. Check the anodes. Clean the anodes if there are scales, grease, or oil.


S6AU3048

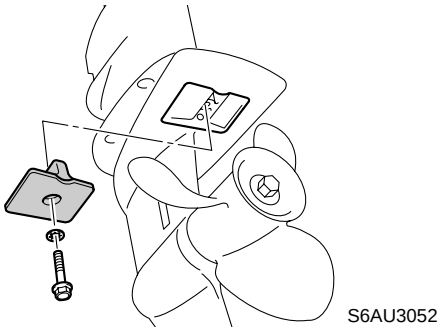
A


S6AG3280

B


S6AU3050

C


S6AU3052

A PT model
B Except for high thrust model
C For high thrust model

CAUTION:

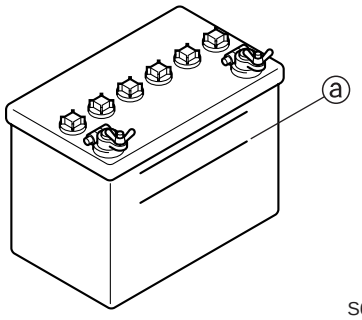
Do not oil, grease, or paint the anodes, otherwise they will be ineffective.

NOTE:

- Replace the anodes if excessively eroded. In addition, check the ground lead.
- If it is necessary to disassemble the outboard motor to check an anode, refer to the applicable disassembly procedure in this manual.

Checking the battery

1. Check the battery electrolyte level. If the level is at or below the minimum level mark ⓐ, add distilled water until the level is between the maximum and minimum level marks.



S69J3620

2. Check the specific gravity of the electrolyte. Fully charge the battery if below specification.

⚠ WARNING

Battery electrolyte is dangerous; it contains sulfuric acid which is poisonous and highly caustic.
Always follow these preventive measures:
- **Avoid bodily contact with electrolyte as it can cause severe burns or permanent eye injury.**
- **Wear protective eye gear when handling or working near batteries.**

Antidote (EXTERNAL):
- **SKIN – Wash with water.**
- **EYES – Flush with water for 15 minutes and get immediate medical attention.**

Antidote (INTERNAL):
- **Drink large quantities of water or milk followed with milk of magnesia, beaten egg, or vegetable oil. Get immediate medical attention.**

Batteries generate explosive, hydrogen gas. Always follow these preventive measures:
- **Charge batteries in a well-ventilated area.**
- **Keep batteries away from fire, sparks, or open flames (e.g., welding equipment, lighted cigarettes).**
- **DO NOT SMOKE when charging or handling batteries.**

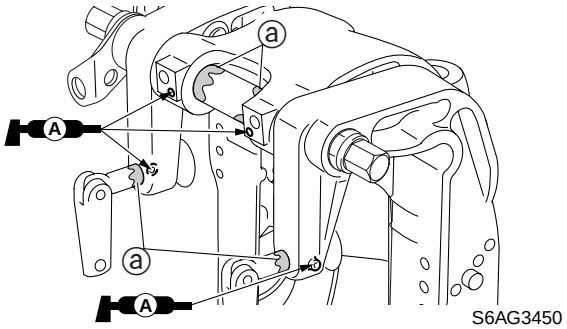
KEEP BATTERIES AND ELECTROLYTE OUT OF REACH OF CHILDREN.

NOTE:
- Batteries vary per manufacturer. The procedures mentioned in this manual may not always apply, therefore, consult the instruction manual of the battery.
- Disconnect the negative battery cable first, then the positive battery cable.

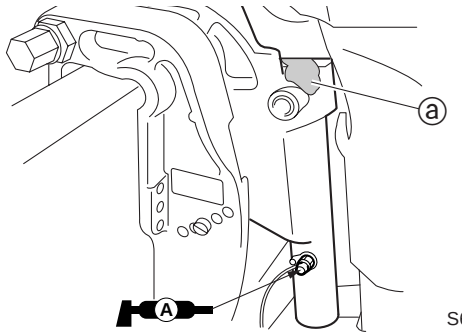
Electrolyte specific gravity:
1.280 at 20 °C (68 °F)

Lubricating the outboard motor

1. Apply water resistant grease to the areas shown.

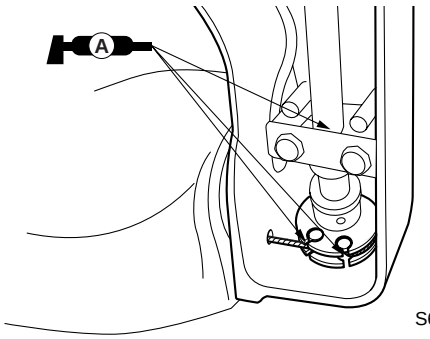


S6AG3450



S6AG3440

A

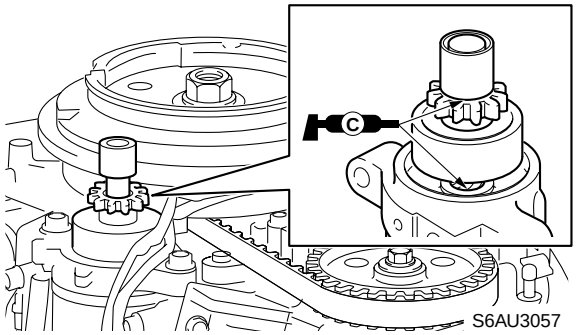


S6AU3056

A H model

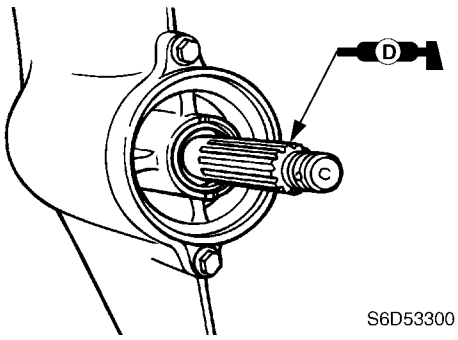
NOTE:
Apply grease until it flows from the bushings ⓐ.

2. Apply low temperature resistant grease to the areas shown.



S6AU3057

3. Apply corrosion resistant grease to the area shown.



— MEMO —

Fuel system

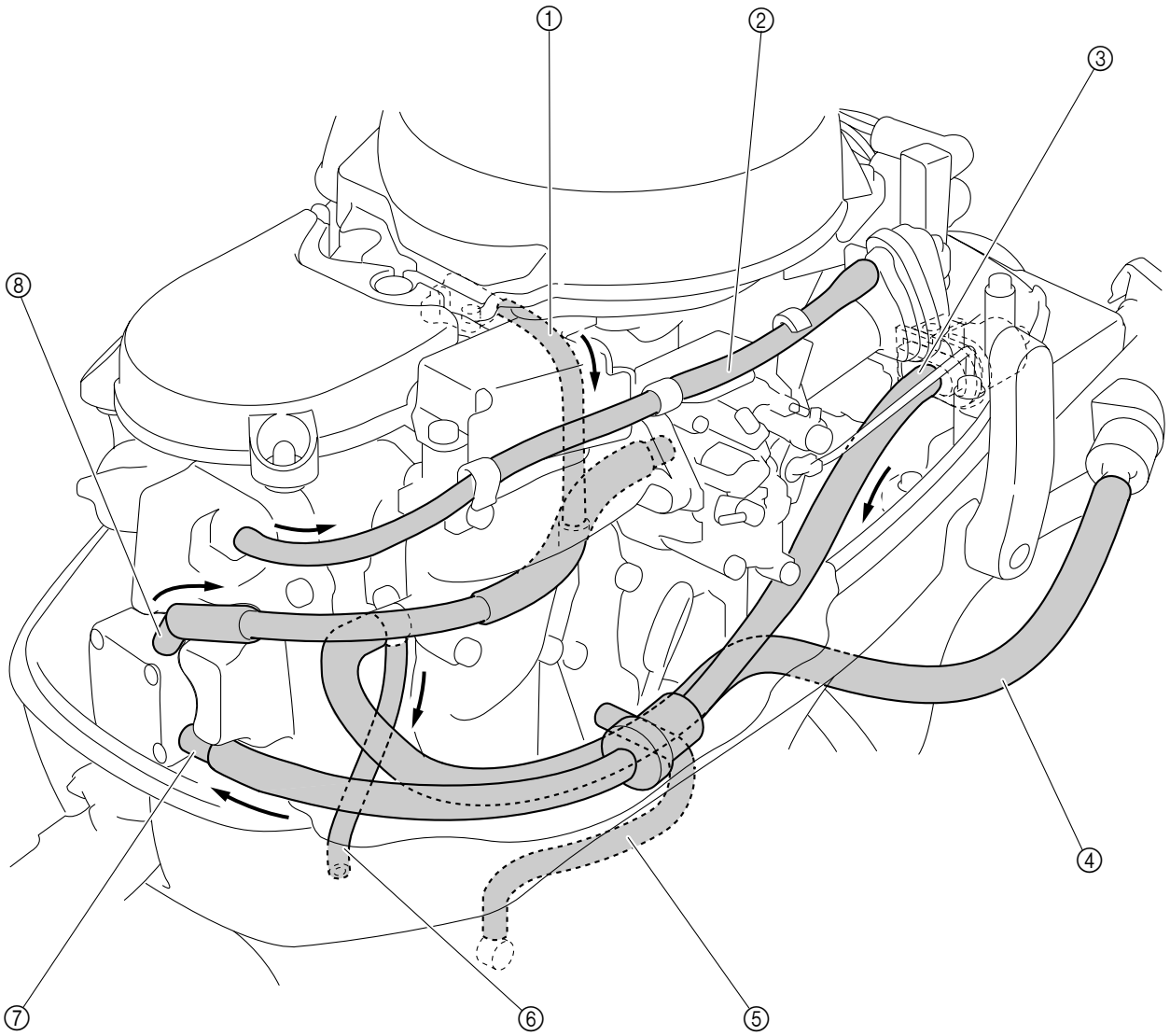
Hose routing 4-1
Fuel hose, blowby hose, and cooling water hose 4-1

Fuel pump, fuel filter, and fuel joint 4-2
Checking the fuel pump 4-4
Checking the fuel filter 4-4
Checking the fuel joint 4-5
Disassembling the fuel pump 4-5
Checking the diaphragm and valve 4-5
Assembling the fuel pump 4-6

Carburetor unit 4-7
Carburetor 4-9
Removing the carburetor 4-11
Disassembling the carburetor 4-11
Checking the carburetor 4-11
Assembling the carburetor 4-12
Installing the carburetor 4-13
Adjusting the pilot screw 4-13

Hose routing

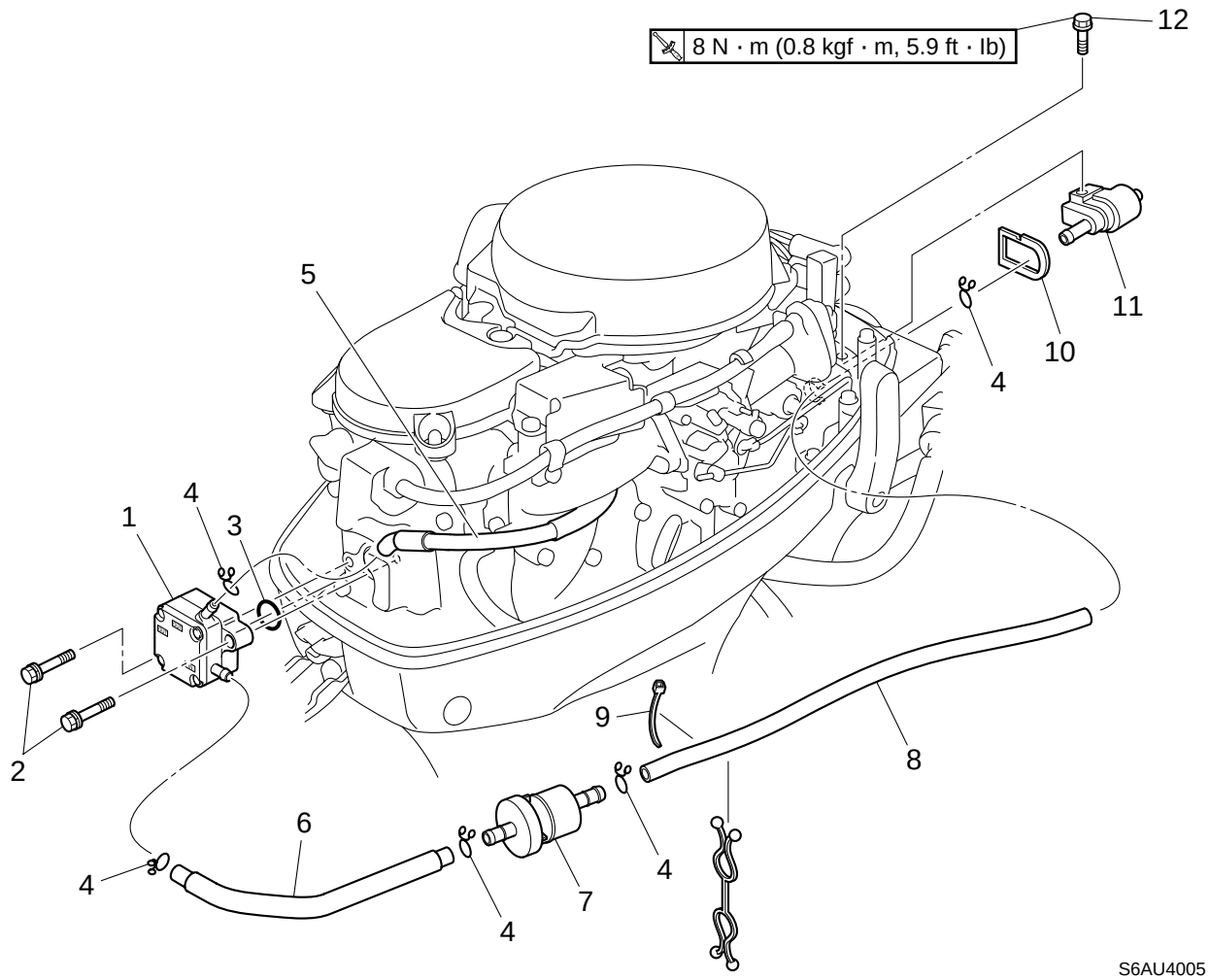
Fuel hose, blowby hose, and cooling water hose



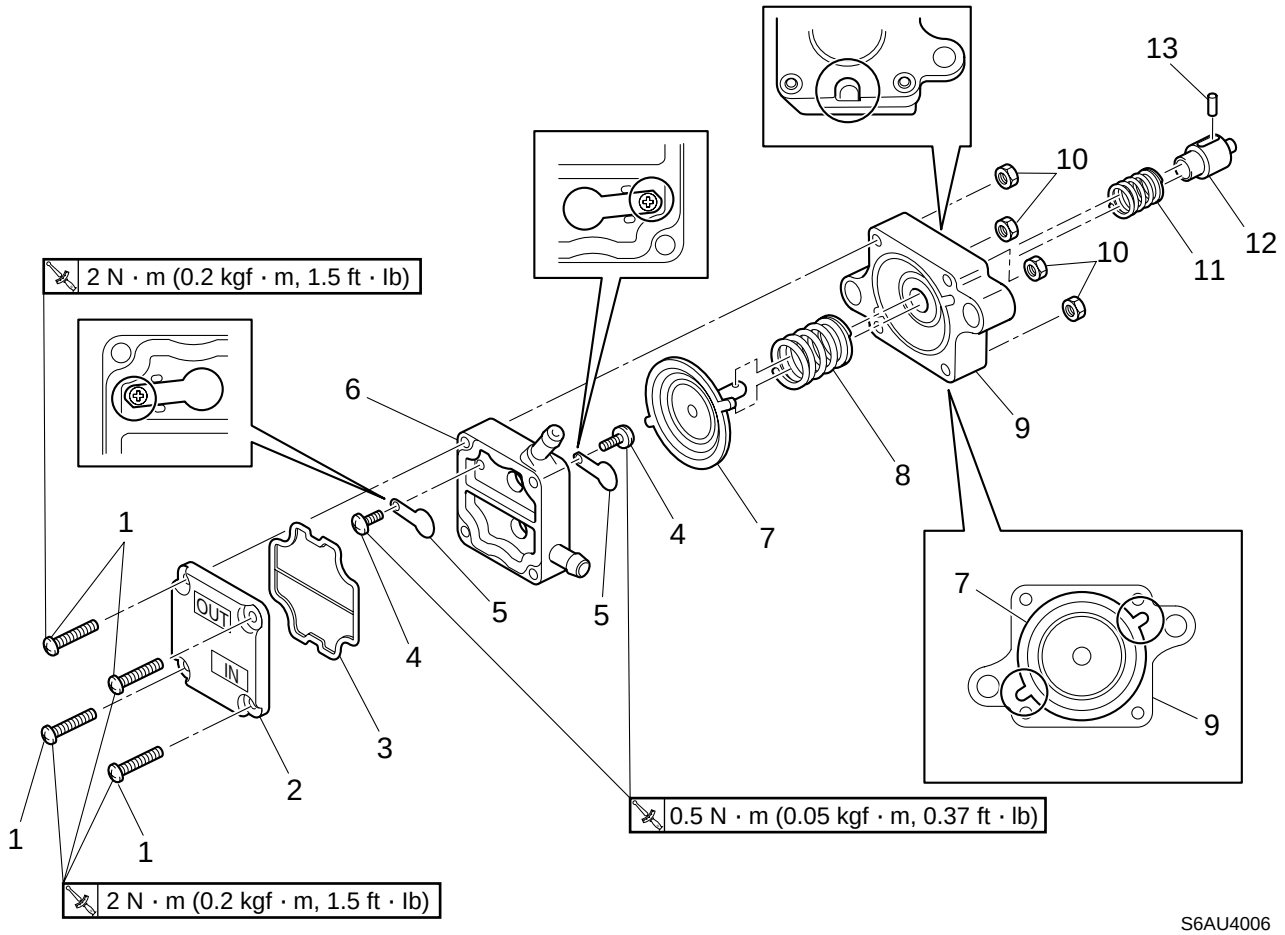
S6AU4001

① Cooling water hose
(thermostat cover-to-cylinder block)
② Blowby hose
(cylinder head cover-to-intake silencer)
③ Fuel hose (fuel joint-to-fuel filter assembly)
④ Flushing hose
(flushing hose adapter-to-intake manifold)
(for Europe)
⑤ Cooling water hose
(exhaust cover-to-exhaust)
⑥ Cooling water hose
(intake manifold-to-cooling water pilot hole)
⑦ Fuel hose (fuel filter assembly-to-fuel pump)
⑧ Fuel hose (fuel pump-to-carburetor assembly)

Fuel pump, fuel filter, and fuel joint



No.	Part name	Q'ty	Remarks
1	Fuel pump	1	
2	Bolt	2	M6 × 30 mm
3	O-ring	1	**Not reusable**
4	Clamp	5	
5	Fuel hose	1	
6	Fuel hose	1	
7	Fuel filter	1	
8	Fuel hose	1	
9	Plastic tie	1	
10	Seal	1	
11	Fuel joint	1	
12	Bolt	1	M6 × 25 mm

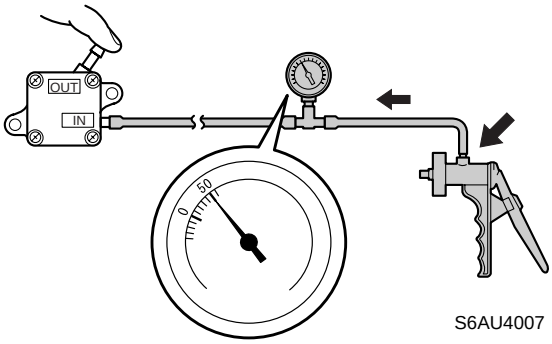


No.	Part name	Q'ty	Remarks
1	Screw	4	ø4 × 30 mm
2	Cover	1	
3	Diaphragm	1	**Not reusable**
4	Screw	2	ø3 × 5 mm
5	Check valve	2	
6	Fuel pump body 2	1	
7	Diaphragm	1	
8	Spring	1	
9	Fuel pump body 1	1	
10	Nut	4	
11	Spring	1	
12	Plunger	1	
13	Pin	1	

Checking the fuel pump

1. Connect the special service tool to the fuel pump inlet.

2. Cover the fuel pump outlet with your finger, and then apply the specified positive pressure. Check that there is no air leakage.

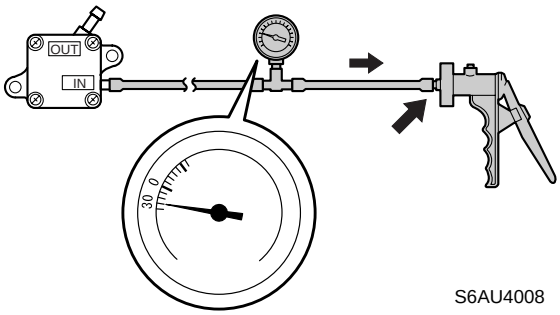


S6AU4007

Vacuum/pressure pump gauge set:
90890-06756

Specified positive pressure:
50 kPa (0.5 kgf/cm^2, 7.3 psi)

3. Apply the specified negative pressure and check that there is no air leakage.

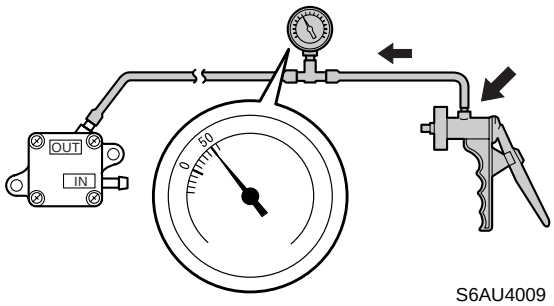


S6AU4008

Specified negative pressure:
30 kPa (0.3 kgf/cm^2, 4.4 psi)

4. Connect the special service tool to the fuel pump outlet.

5. Apply the specified positive pressure and check that there is no air leakage.



S6AU4009

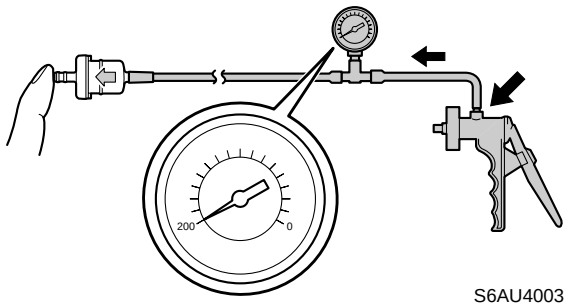
Specified positive pressure:
50 kPa (0.5 kgf/cm^2, 7.3 psi)

Checking the fuel filter

NOTE:
To check the fuel filter, see “Checking the fuel filter” (3-3).

1. Connect a vacuum/pressure pump gauge and a meter to the fuel inlet.

2. Cover the fuel outlet with your finger, and then apply the specified positive pressure. Replace the fuel filter if the specified pressure cannot be maintained for at least 10 seconds.



S6AU4003

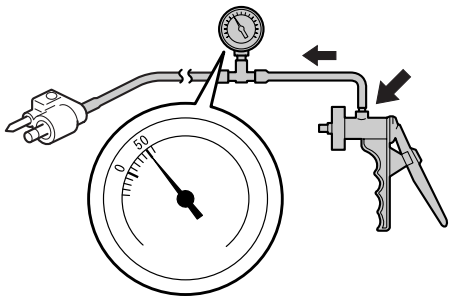
NOTE:
Use a commercially available vacuum/pressure pump gauge and meter that can be pressurized up to 200 kPa (2.0 kgf/cm^2, 29.0 psi).

Specified positive pressure:
200 kPa (2.0 kgf/cm^2, 29.0 psi)

4

Checking the fuel joint

1. Check the fuel joint. Replace if cracked or damaged.
2. Connect the special service tool to the fuel joint outlet.
3. Apply the specified positive pressure. Replace the fuel joint if the specified pressure cannot be maintained for at least 10 seconds.



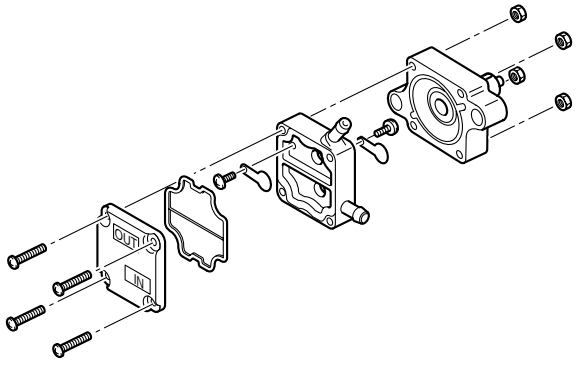
S6AU4004

Vacuum/pressure pump gauge set:
90890-06756

Specified positive pressure:
50 kPa (0.5 kgf/cm^2, 7.3 psi)

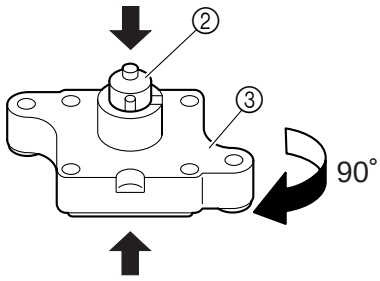
Disassembling the fuel pump

1. Disassemble the fuel pump as shown.

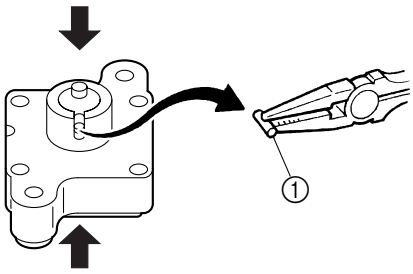


S6AU4010

2. Remove the pin ① from the plunger ②, and then disassemble fuel pump body 1 ③.



S6AU4011



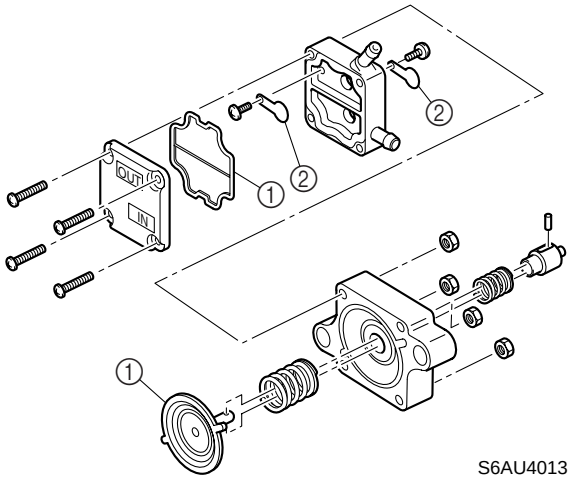
S6AU4012

NOTE:

- Push the plunger ② and diaphragm completely inward, and then turn fuel pump body 1 ③ approximately 90° to a position where the pin ① can be removed easily.
- Slowly release on the plunger ② and diaphragm, and then remove them.

Checking the diaphragm and valve

1. Check the diaphragms ① and valves ②. Replace the diaphragms if torn and the valves if cracked.

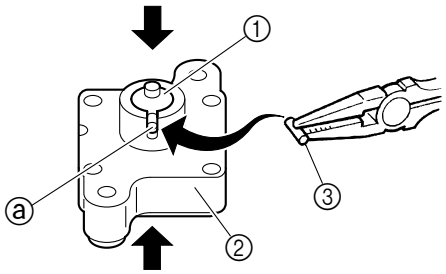


S6AU4013

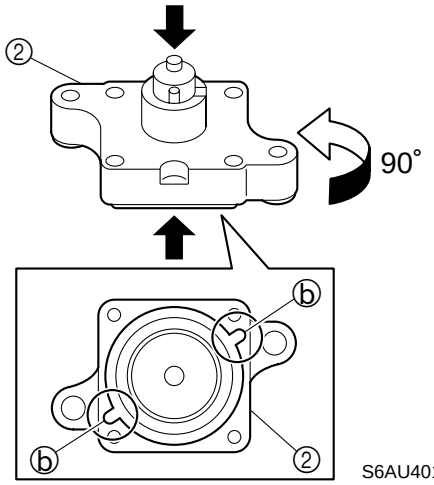
Assembling the fuel pump

NOTE:
Clean the parts and soak the valves and the diaphragms in gasoline before assembly.

1. Install the plunger ① and diaphragm into fuel pump body 1 ②, and then install the pin ③ to the plunger ①.



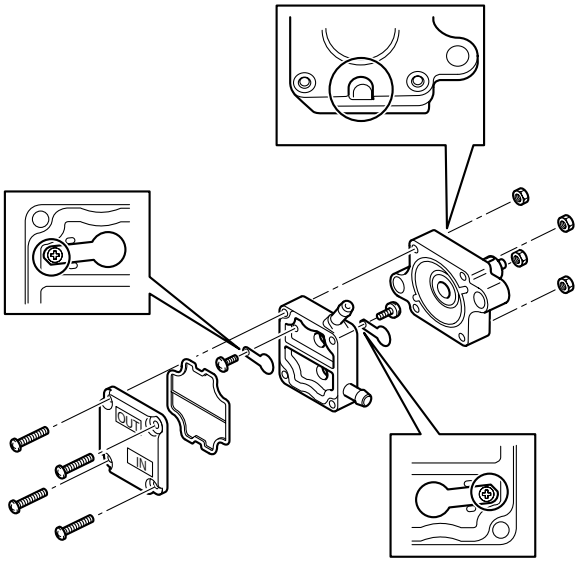
S6AU4014



S6AU4015

NOTE:
- Align the pin installation holes ⓐ with the slot in fuel pump body 1 ②, and then install the pin ③ while pushing the plunger ① and diaphragm completely inward.
- Turn fuel pump body 1 ② until the pin ③ is 90° from the slot in the body.
- Make sure that the projections ⓑ on the diaphragm fit correctly into fuel pump body 1 ②.

2. Assemble the fuel pump as shown.

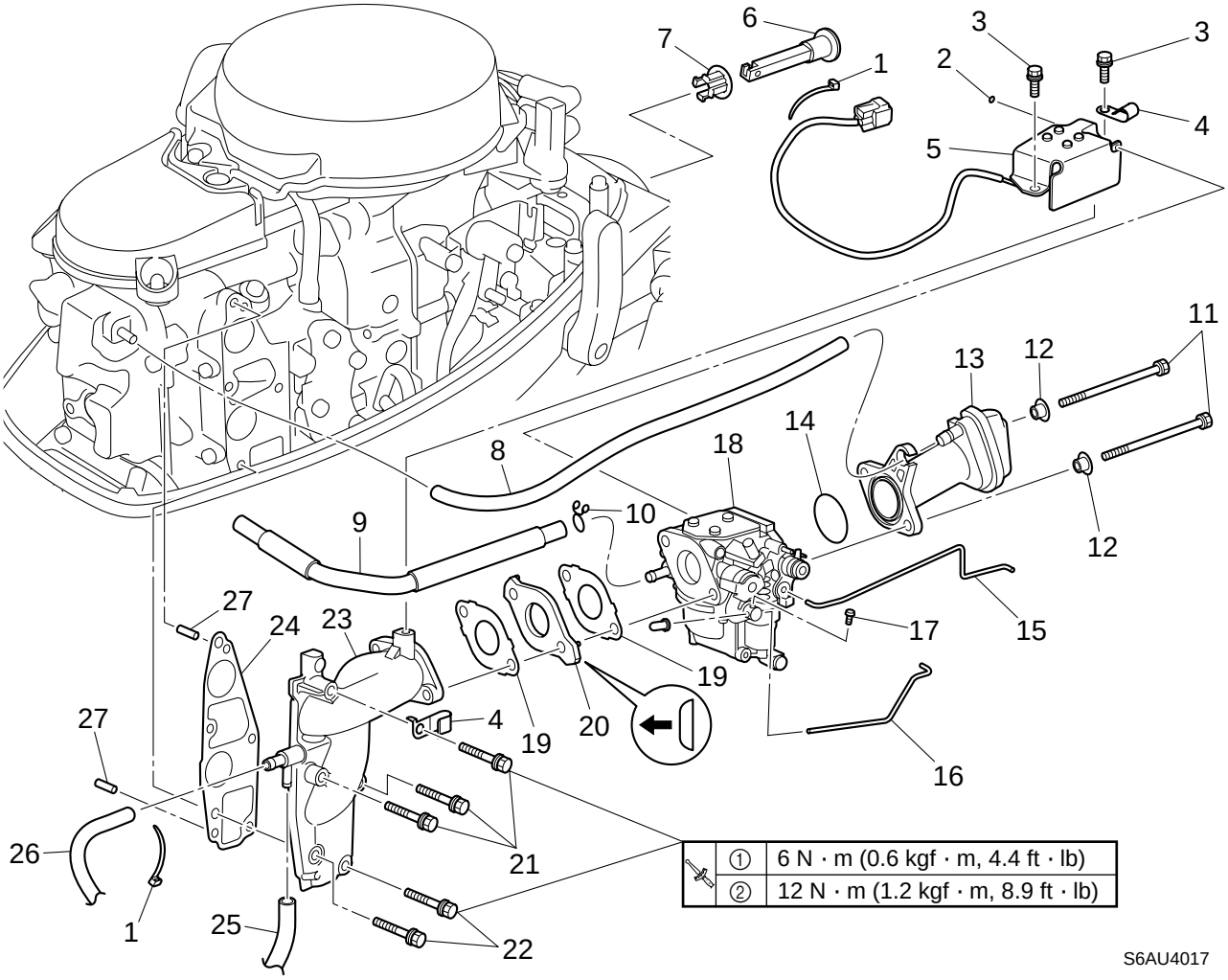


S6AU4016

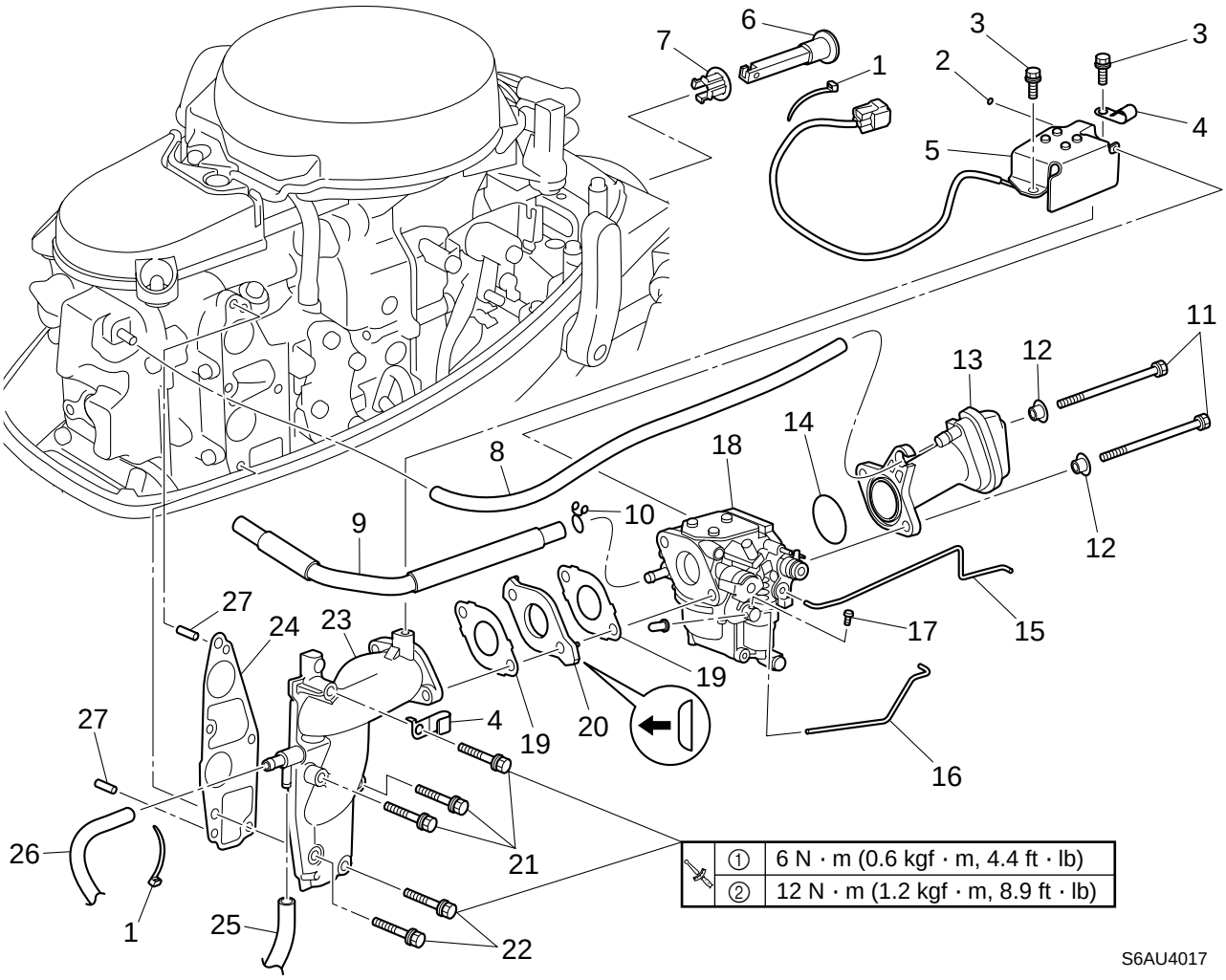
NOTE:
- Moisten the inside of the fuel pump with gasoline to ensure a good seal.
- Make sure that the diaphragms are kept in place through the assembly process.
- After disassembling and assembling the fuel pump, check it for air leaks. See “Checking the fuel pump” (4-4).

4

Carburetor unit

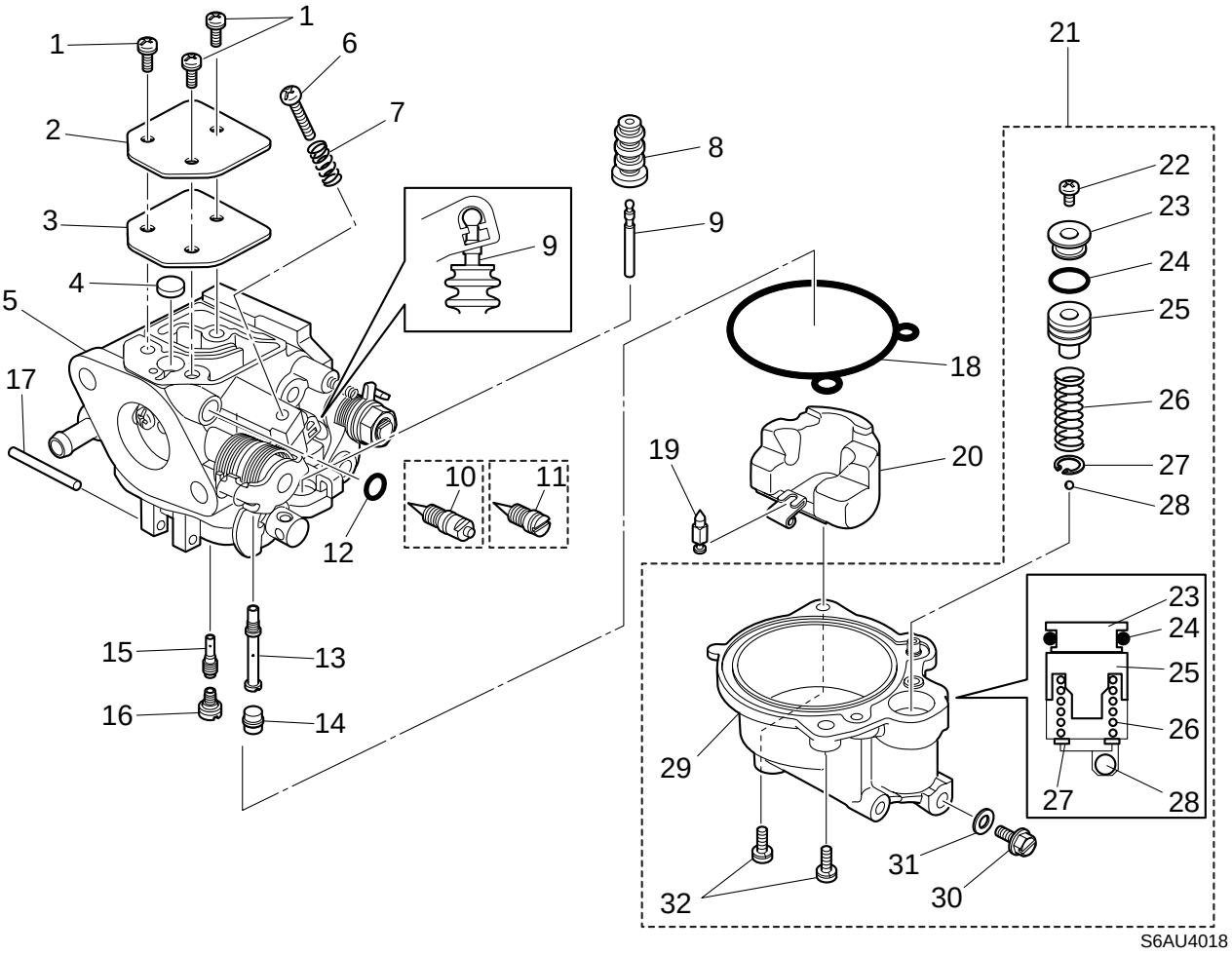


No.	Part name	Q'ty	Remarks
1	Plastic tie	2	
2	O-ring	1	R model
3	Bolt	2	M6 × 12 mm
4	Holder	2	
5	Choke solenoid	1	R model
6	Choke knob	1	
7	Choke knob guide	1	
8	Blowby hose	1	
9	Fuel hose	1	
10	Clamp	1	
11	Bolt	2	M6 × 85 mm
12	Collar	2	
13	Intake silencer	1	
14	O-ring	1	**Not reusable**
15	Choke rod	1	
16	Throttle link rod	1	
17	Screw	1	ø4 × 6 mm

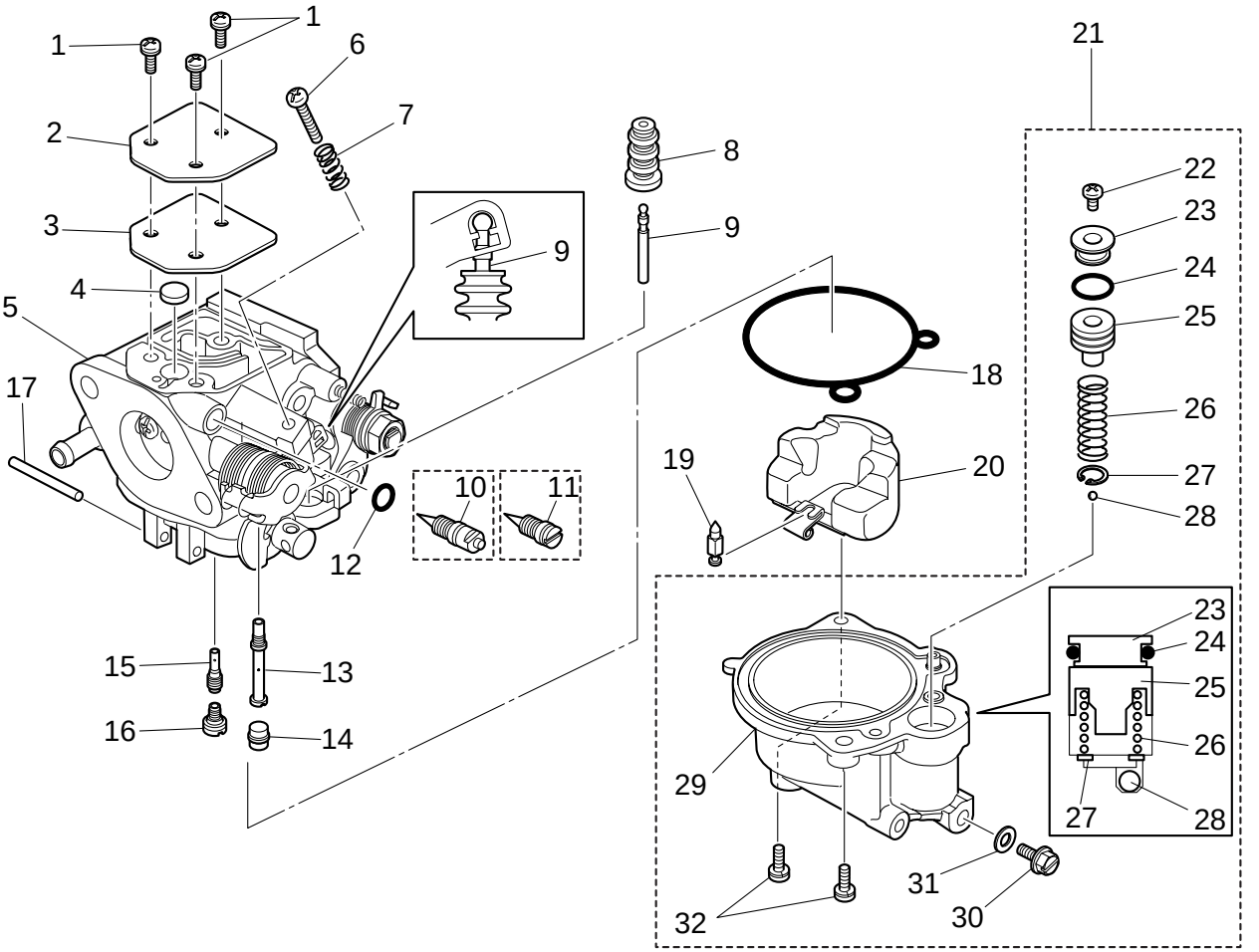


No.	Part name	Q'ty	Remarks
18	Carburetor assembly	1	
19	Gasket	2	**Not reusable**
20	Spacer	1	
21	Bolt	3	M6 × 35 mm
22	Bolt	2	M6 × 25 mm
23	Intake manifold	1	
24	Gasket	1	**Not reusable**
25	Cooling water hose	1	
26	Flushing hose	1	For Europe
27	Dowel	2	

Carburetor



No.	Part name	Q'ty	Remarks
1	Screw	3	ø4 × 10 mm
2	Cover	1	
3	Gasket	1	**Not reusable**
4	Plug	1	
5	Carburetor body	1	
6	Throttle stop screw	1	ø4 × 20 mm
7	Spring	1	
8	Boot	1	
9	Plunger rod	1	
10	Pilot screw	1	For Europe
11	Pilot screw	1	For Oceania
12	O-ring	1	**Not reusable**
13	Main nozzle	1	
14	Plug	1	
15	Pilot jet	1	
16	Main jet	1	
17	Float pin	1	

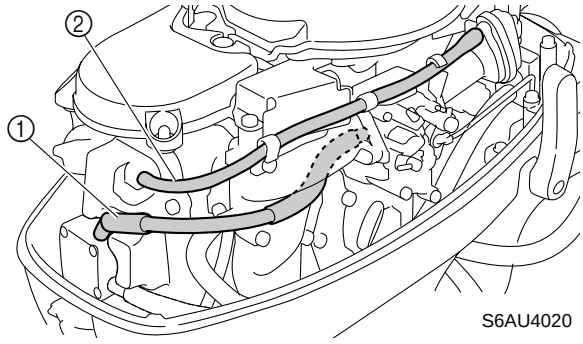


S6AU4018

No.	Part name	Q'ty	Remarks
18	Gasket	1	**Not reusable**
19	Needle valve	1	
20	Float	1	
21	Float chamber assembly	1	
22	Screw	1	ø3 × 6 mm
23	Plunger rod guide	1	
24	O-ring	1	**Not reusable**
25	Plunger	1	
26	Spring	1	
27	Circlip	1	
28	Ball	1	
29	Float chamber	1	
30	Drain screw	1	
31	Gasket	1	**Not reusable**
32	Screw	2	ø4 × 10 mm

Removing the carburetor

1. Disconnect the fuel hose ① and blowby hose ②.

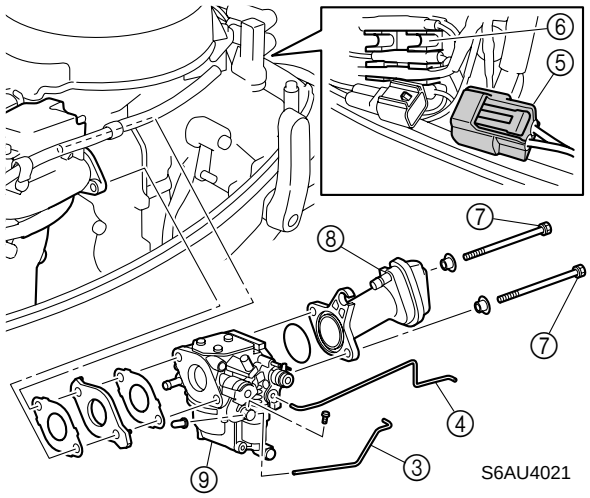


2. Disconnect the throttle link rod ③ and choke rod ④.

3. Disconnect the choke solenoid coupler ⑤. (R model)

NOTE:
The choke solenoid coupler ⑤ is located under the junction box ⑥.

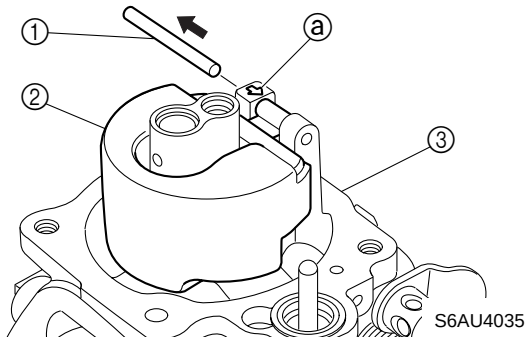
4. Remove the bolts ⑦, and then remove the intake silencer ⑧ and carburetor assembly ⑨.



Disassembling the carburetor

NOTE:
See the exploded diagram for disassembly (4-9).

1. Remove the float pin ①, float ②, and needle valve.

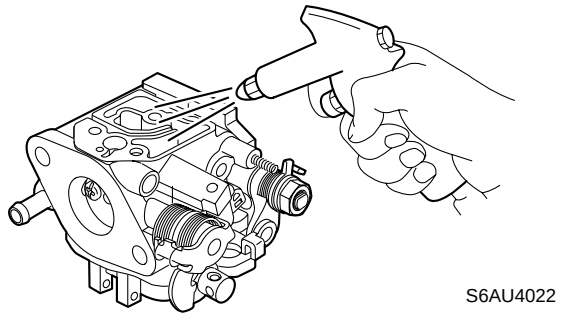


NOTE:
Remove the float pin ① in the direction of the arrow shown, which is opposite to the arrow mark ⓐ on the carburetor body ③.

Checking the carburetor

1. Check the air and fuel passages and jets. Clean the carburetor body if there is dirt or foreign material.

2. Blow compressed air into all passages and jets.

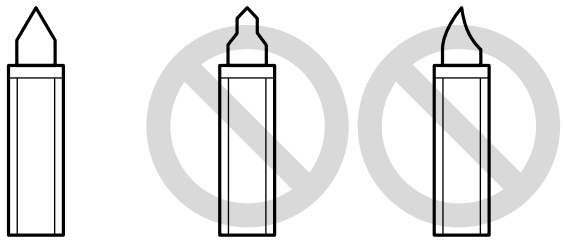


⚠ WARNING
Wear appropriate protective eye gear during the cleaning process to prevent any eye injury by the blown-off debris or liquid.

3. Check the main jet, pilot jet, and main nozzle. Clean if there is dirt or residue.

CAUTION:
Do not use steel wire clean the jets, otherwise the jet diameters may be enlarged, which may seriously affect performance.

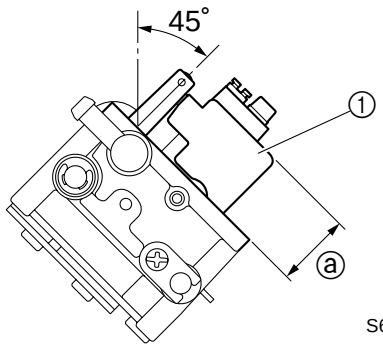
4. Check the pilot screw and needle valve. Replace if worn or deformed.



S6AG4200

5. Check the float. Replace if cracked or deformed.

6. Measure the float height ⓐ. Replace the float ① or needle valve if out of specification.



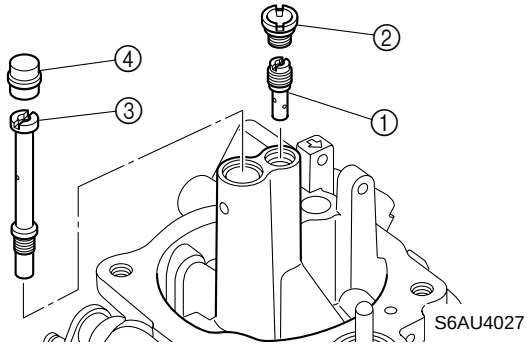
S6AU4024

NOTE:
- When measuring the float height ⓐ, hold the carburetor body at a 45° angle as shown so that there is no load on the needle valve spring.
- Take measurements at the float position shown opposite its pivoting side.

Float height ⓐ:
20.0–21.0 mm (0.79–0.83 in)

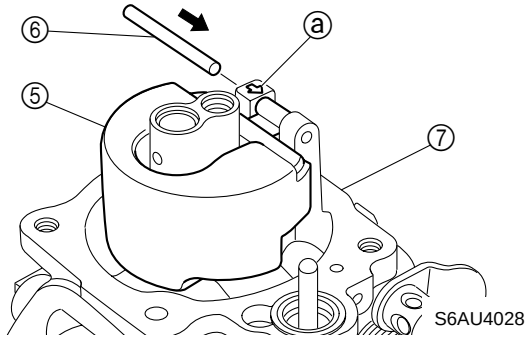
Assembling the carburetor

1. Install the pilot jet ①, main jet ②, main nozzle ③, and plug ④ to the carburetor body as shown.



S6AU4027

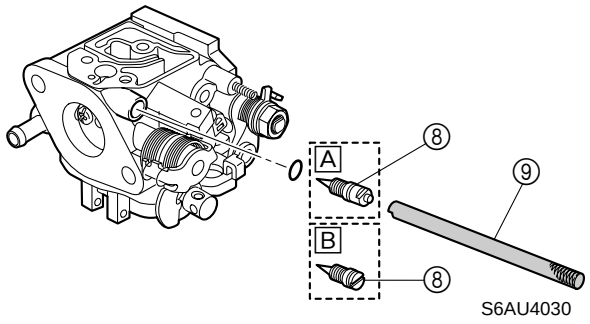
2. Install the needle valve, float ⑤, and float pin ⑥ as shown, and then check the float for smooth operation.



S6AU4028

NOTE:
Install the float pin ⑥ in the direction of the arrow mark ⓐ on the carburetor body ⑦.

3. Install the pilot screw ⑧, turn it in until it is lightly seated, and then turn it out the specified number of turns.



A For Europe
B For Oceania

Pilot screw adjusting tool ⑨ (for Europe): 90890-03154

Pilot screw setting: 1 5/8 turns out

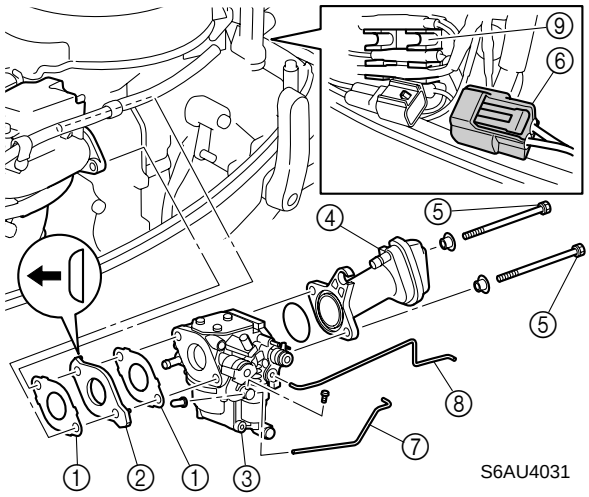
Installing the carburetor

1. Install new gaskets ①, the spacer ②, the carburetor assembly ③, and the intake silencer ④ using the bolts ⑤.

NOTE:
Install the spacer ② with the chamfered side facing toward the intake manifold.

2. Connect the choke solenoid coupler ⑥. (R model)

3. Connect the throttle link rod ⑦ to the carburetor throttle lever and the choke rod ⑧ to the carburetor choke lever.



NOTE:
- To adjust the throttle link rod, see "Adjusting the throttle link" (3-9).
- Place the choke solenoid coupler ⑥ under the junction box ⑨ after connecting it.

4. Adjust the engine idle speed.

NOTE:
If the carburetor has been disassembled and assembled, adjust the pilot screw, and then adjust the engine idle speed. See "Adjusting the pilot screw" (4-13).

Adjusting the pilot screw

1. Adjust the throttle stop screw.

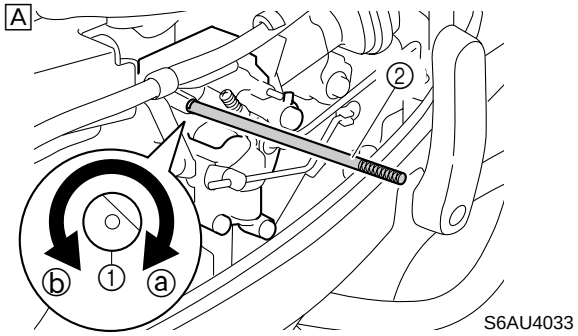
NOTE:
If the carburetor was disassembled, turn the throttle stop screw in until it contacts the carburetor throttle lever, and then turn it in about 1 1/2–1 3/4 turns to tighten it temporarily.

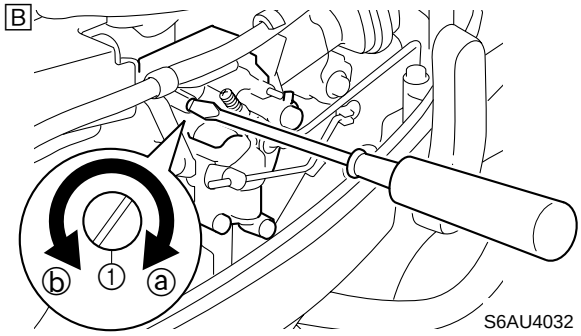
2. Start the engine and warm it up.

3. Attach the special service tool to spark plug wire #1.

Digital tachometer: 90890-06760

4. Turn the pilot screw ① in direction ⓐ until it is lightly seated, and then turn it in direction ⓑ the specified number of turns.



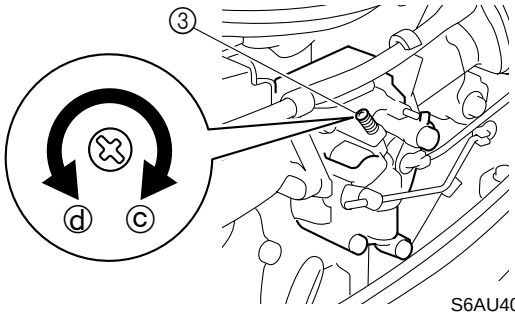


A For Europe
B For Oceania

Pilot screw adjusting tool ② (for Europe): 90890-03154

Pilot screw setting: 1 5/8 turns out

5. Turn the throttle stop screw ③ in direction ⓒ or ⓓ until the specified engine idle speed is obtained.



NOTE:
- To increase the engine idle speed, turn the throttle stop screw ③ in direction ⓒ.
- To decrease the engine idle speed, turn the throttle stop screw ③ in direction ⓓ.

Engine idle speed: 1,050 ± 50 r/min

6. After adjusting the engine idle speed, rev the engine a few times and let it idle to check the stability of the engine.

4

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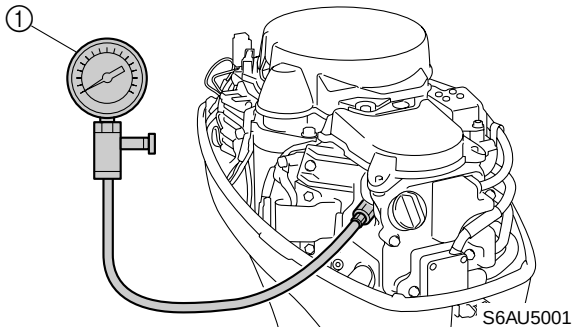
5

Power unit (check and adjustment)

Checking the compression pressure

1. Start the engine, warm it up, and then turn it off.
2. Remove the clip from the engine shut-off switch.
3. Disconnect the spark plug caps, remove the spark plugs, and then install the special service tool ① into a spark plug hole.



CAUTION:

Before removing the spark plugs, remove any dirt or dust in the spark plug wells that may fall into the cylinders.

Compression gauge ①:
90890-03160

4. Fully open the throttle and fully push in the choke knob.
5. Crank the engine until the reading on the compression gauge stabilizes, and then measure the compression pressure.

Minimum compression pressure (reference data):
630 kPa (6.3 kgf/cm^2, 91.4 psi) (M model)
700 kPa (7.0 kgf/cm^2, 101.5 psi) (E model)

6. If the compression pressure is below specification or the compression pressure for each cylinder is unbalanced, add a small amount of engine oil to the cylinder, and then measure the pressure again.

NOTE:

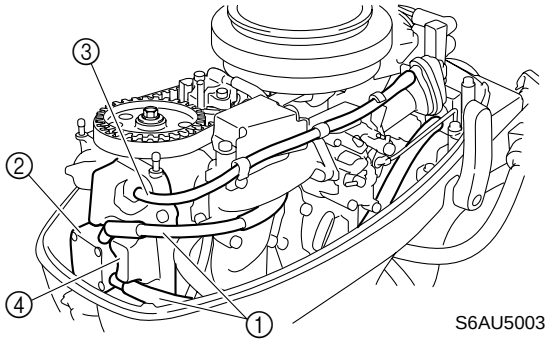
- If the compression pressure increases, check the pistons and piston rings. Replace if worn.
- If the compression pressure does not increase, check the valve clearances, valves, valve seats, cylinder sleeves, cylinder head gasket, and cylinder head. Adjust or replace if necessary.

Checking the valve clearance

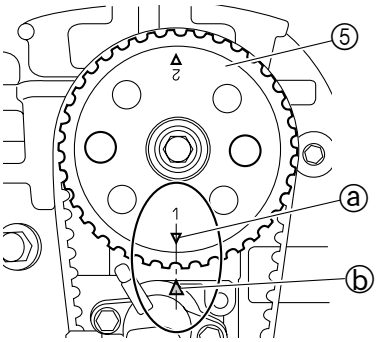
NOTE:

Measure the valve clearances when the engine is cold.

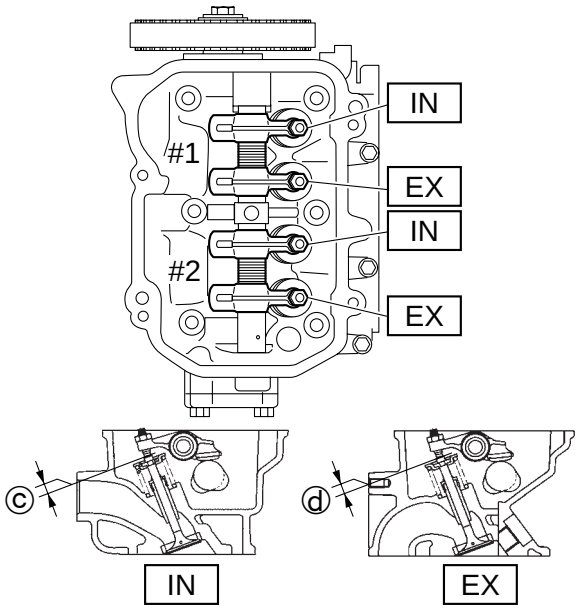
1. Remove the driven sprocket cover and manual starter. (M model)
   Remove the driven sprocket cover and flywheel magnet cover. (E model)
2. Disconnect the spark plug caps and remove the spark plugs.
3. Remove the fuel hoses ①, fuel pump ②, blowby hose ③, and cylinder head cover ④.



4. Turn the flywheel magnet clockwise and align the "1 ▲" mark ⓐ on the driven sprocket ⑤ with the "▲" mark ⓑ on the thermostat cover.



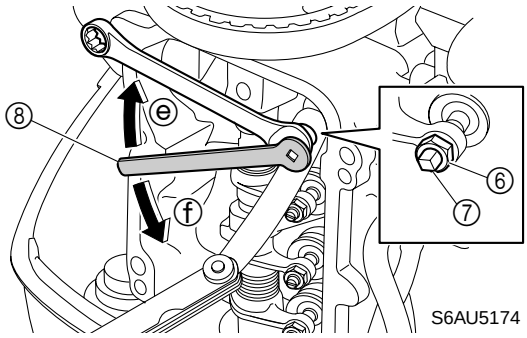
5. Measure the intake and exhaust valve clearances for cylinder #1. Adjust if out of specification.



NOTE:
Note the measurement data.

Valve clearance:
Intake ⓒ:
0.15–0.20 mm (0.006–0.008 in)
Exhaust ⓓ:
0.20–0.25 mm (0.008–0.010 in)

6. Loosen the rocker arm locknut ⑥, and then turn the adjusting screw ⑦ until the specified valve clearance is obtained.



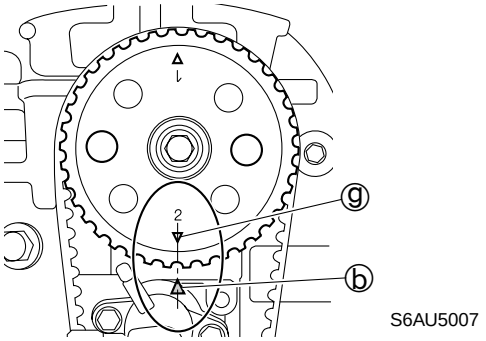
NOTE:
- To decrease the valve clearance, turn the adjusting screw in direction ⓔ.
- To increase the valve clearance, turn the adjusting screw in direction ⓕ.

Tappet adjusting tool ⑧:
90890-01311

7. Tighten the rocker arm locknut ⑥ to the specified torque.

Rocker arm locknut ⑥:
7 N·m (0.7 kgf·m, 5.2 ft·lb)

8. Turn the flywheel magnet an additional 360° clockwise and align the "2 ▲" mark ⓖ on the driven sprocket with the "▲" mark ⓑ on the thermostat cover.



9. Repeat steps 5–7 for cylinder #2.

10. Install all parts removed during removal.

Replacing the timing belt

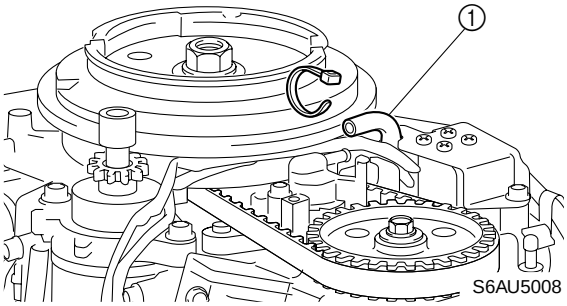
CAUTION:

Do not turn the flywheel magnet counterclockwise, otherwise the water pump impeller may be damaged.

NOTE:

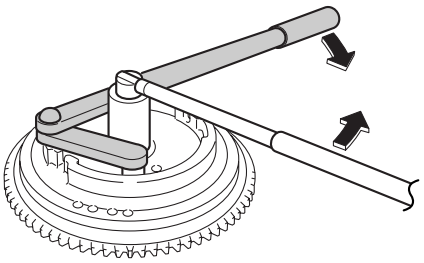
To remove and install the timing belt, drive sprocket, and driven sprocket, see “Removing the timing belt and sprocket” (5-21) and “Installing the sprocket and timing belt” (5-22).

1. Disconnect the spark plug caps and remove the spark plugs.
2. Disconnect the cooling water hose ① from the thermostat cover.



S6AU5008

3. Remove the flywheel magnet nut.


S6AG5G30

⚠ WARNING

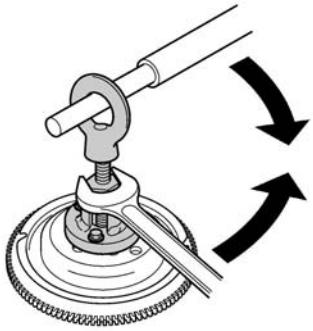
Apply force in the direction of the arrows shown to prevent the flywheel holder from slipping off easily.

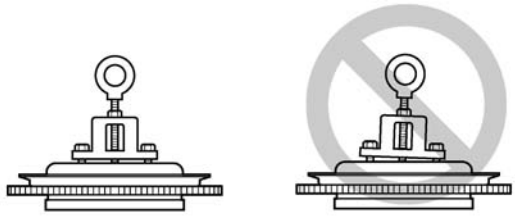
NOTE:

Use a 22 mm socket to loosen the flywheel magnet nut.

	Flywheel holder: 90890-06522

4. Remove the flywheel magnet and Woodruff key.


S63P5280


S63P5290

CAUTION:

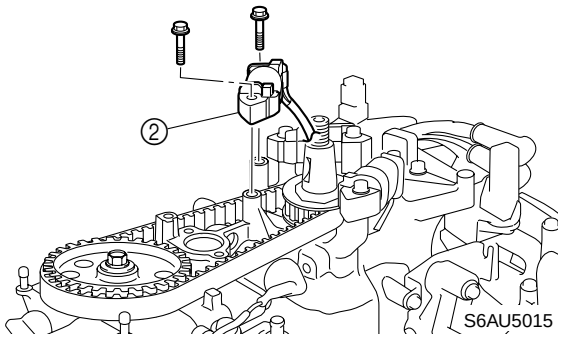
To prevent damage to the engine or tools, screw in the puller set bolts evenly and completely so that the flywheel puller is parallel to the flywheel magnet.

NOTE:

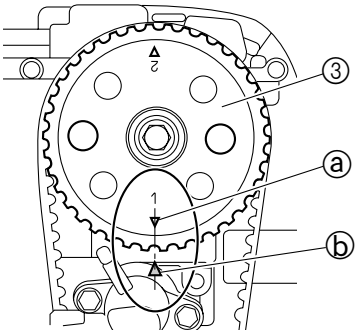
Apply force to the crankshaft end until the flywheel magnet comes off the tapered portion of the crankshaft.

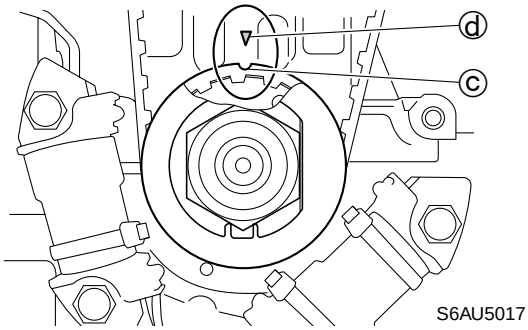
	Flywheel puller: 90890-06521

5. Remove the charge coil ②.



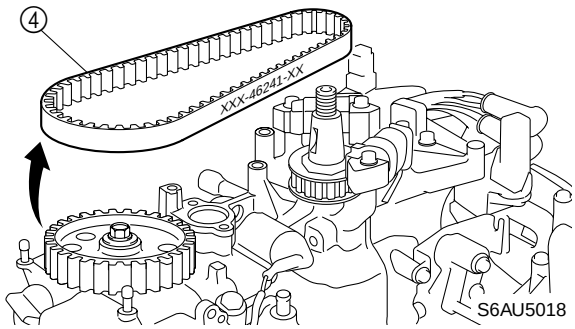
6. Align the "1 ▲" mark ⓐ on the driven sprocket ③ with the "▲" mark ⓑ on the thermostat cover.





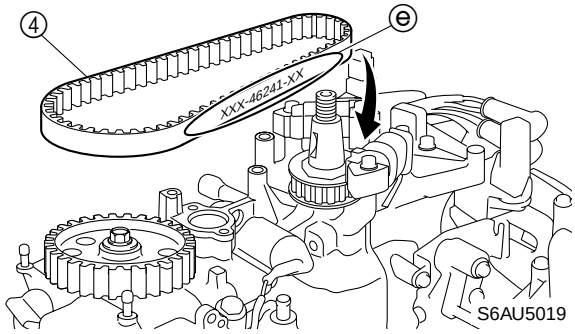
NOTE:
Check that the notch ⓒ in the drive sprocket and the "▲" mark ⓓ on the cylinder block are aligned.

7. Remove the timing belt ④ from the driven sprocket, and then remove it from the drive sprocket.



CAUTION:
Unless directed to do so in the following instructions, do not turn the drive sprocket or driven sprocket when the timing belt is not installed. Otherwise the pistons and valves will collide with each other and be damaged.

8. Install a new timing belt ④ onto the drive sprocket, and then install it onto the driven sprocket with its part number ⓔ in the upright position.

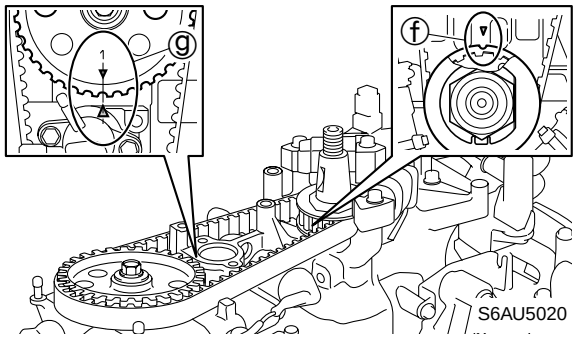


CAUTION:
- **Do not twist, turn inside out, or bend the timing belt beyond the maximum limit of 25 mm (1.0 in), otherwise it can be damaged.**
- **Do not get oil or grease on the timing belt.**

NOTE:
Before installing the timing belt, make sure that the notch on the drive sprocket and the mark on the driven sprocket are aligned with the marks on the cylinder block and thermostat cover.

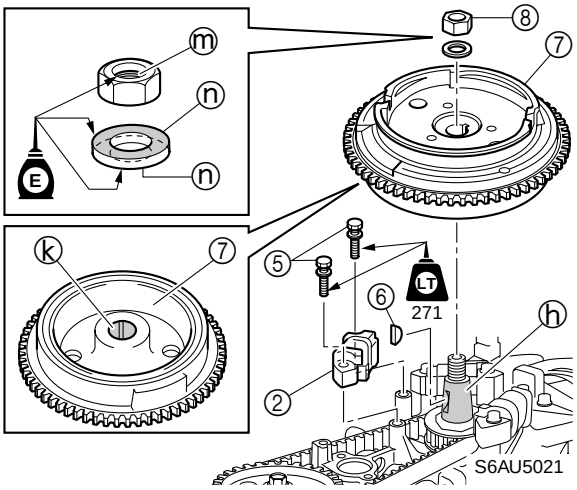
5

9. Turn the drive sprocket clockwise 2 turns, and then check that the parts are aligned at the areas ⓕ and ⓖ as shown.



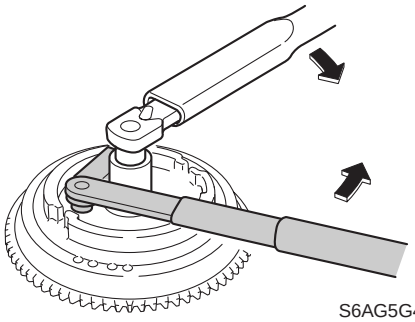
10. Install the charge coil ② and tighten the charge coil bolts ⑤ to the specified torque.

11. Install the Woodruff key ⑥, and then install the flywheel magnet ⑦.



NOTE:
- Be sure to remove any grease from the tapered portion ⓗ of the crankshaft and the inner surface ⓚ of the flywheel magnet.
- Apply engine oil to the threads ⓜ of the flywheel magnet nut ⑧ and upper and lower surfaces ⓝ of the washer before installation.

12. Tighten the flywheel magnet nut ⑧ to the specified torque.



⚠ WARNING

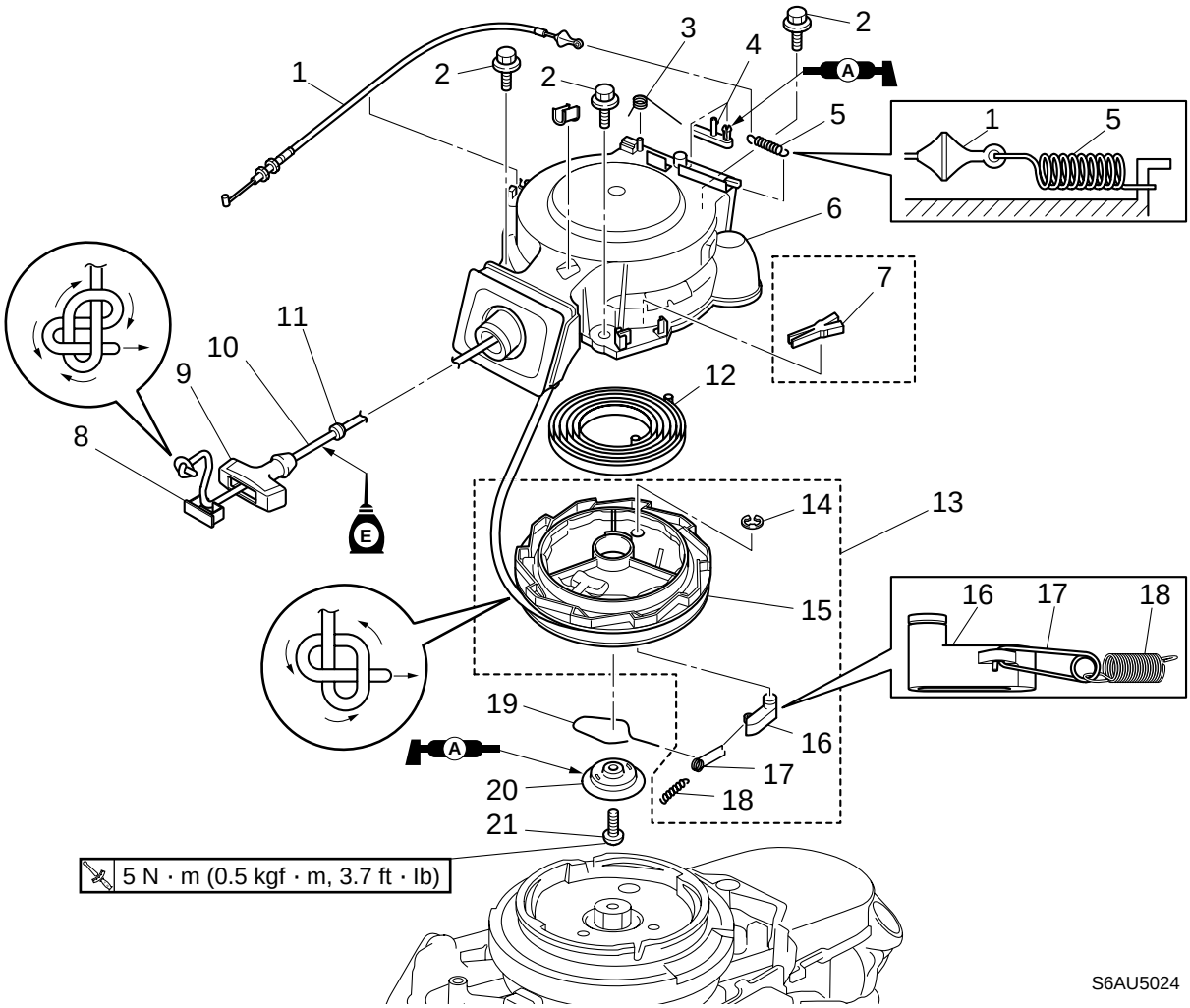
Apply force in the direction of the arrows shown to prevent the flywheel holder from slipping off easily.

	Flywheel holder: 90890-06522

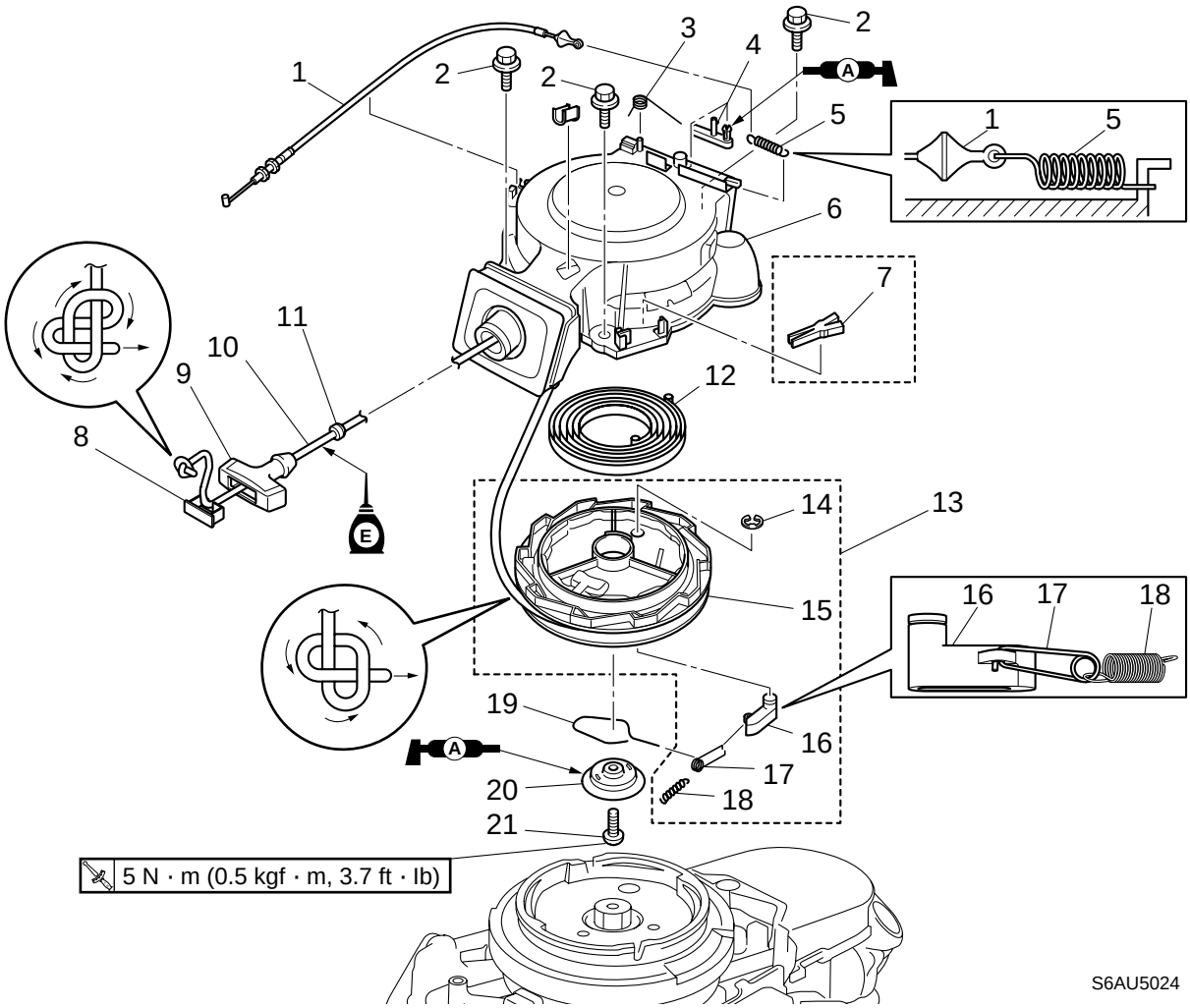
	Charge coil bolt ⑤: 12 N·m (1.2 kgf·m, 8.9 ft·lb) Flywheel magnet nut ⑧: 98 N·m (9.8 kgf·m, 72.3 ft·lb)

13. Install all parts removed during disassembly.

Manual starter (M model)



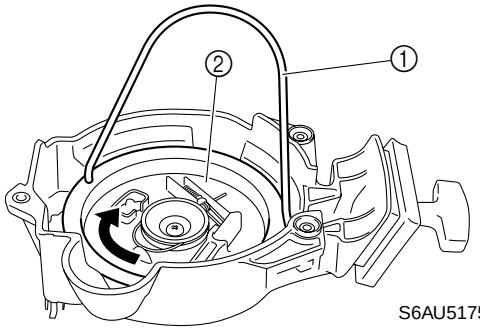
No.	Part name	Q'ty	Remarks
1	Start-in-gear protection cable	1	
2	Bolt	3	M6 × 20 mm
3	Spring	1	
4	Starter plunger	1	
5	Spring	1	
6	Cover	1	
7	Fuse puller	1	E model
8	Cap	1	
9	Starter handle	1	
10	Starter rope	1	1,900 mm (74.8 in) (reference data)
11	Damper	1	
12	Spiral spring	1	
13	Sheave drum assembly	1	
14	E-clip	1	
15	Sheave drum	1	
16	Drive pawl	1	
17	Drive pawl spring 2	1	



No.	Part name	Q'ty	Remarks
18	Spring	1	
19	Drive pawl spring 1	1	
20	Drive plate	1	
21	Screw	1	ø5 × 20 mm

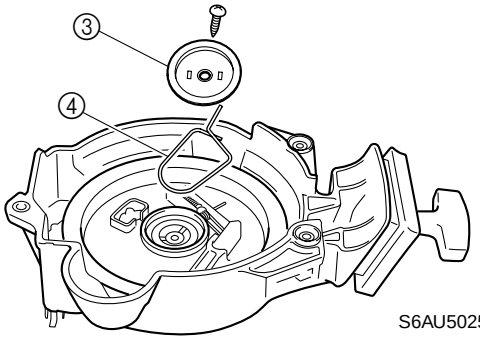
Disassembling the manual starter

1. While holding the starter rope ①, turn the sheave drum ② in the direction of the arrow shown until there is no tension in the spiral spring.



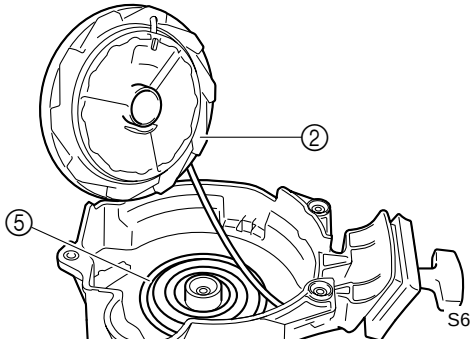
S6AU5175

2. Remove the drive plate ③ and drive pawl spring 1 ④.



S6AU5025

3. Remove the sheave drum ②.



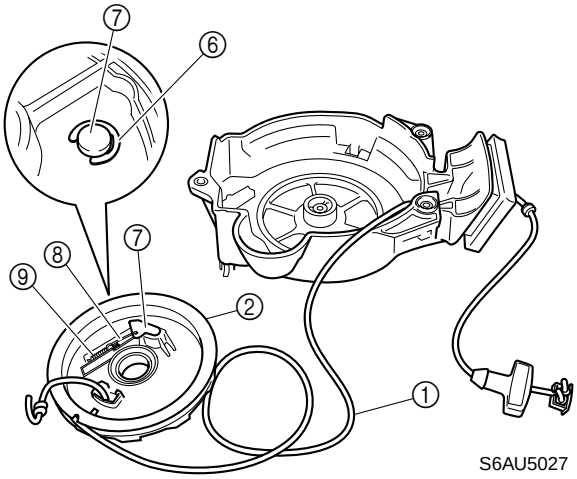
S6AU5026

4. Remove the spiral spring ⑤ from the manual starter cover.

⚠ WARNING

The spiral spring can pop out. Cover the spiral spring with rags when removing it.

5. Remove the starter rope ① and E-clip ⑥, and then remove the drive pawl ⑦, drive pawl spring 2 ⑧, and spring ⑨ from the sheave drum ②.

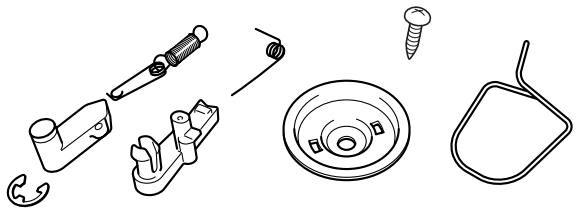


S6AU5027

Checking the manual starter

1. Check the drive pawl, E-clip, starter plunger, and drive plate. Replace if cracked or damaged.

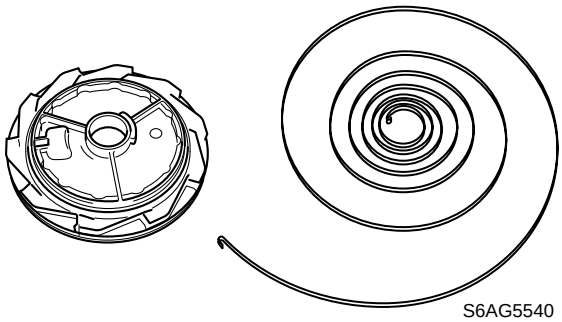
2. Check the springs. Replace if bent, cracked, or damaged.


S6AG5550

5

3. Check the sheave drum. Replace if cracked or damaged.

4. Check the spiral spring. Replace if cracked, bent, or damaged.


S6AG5540

5. Check the starter handle. Replace if cracked or damaged.

6. Check the starter rope. Replace if damaged.

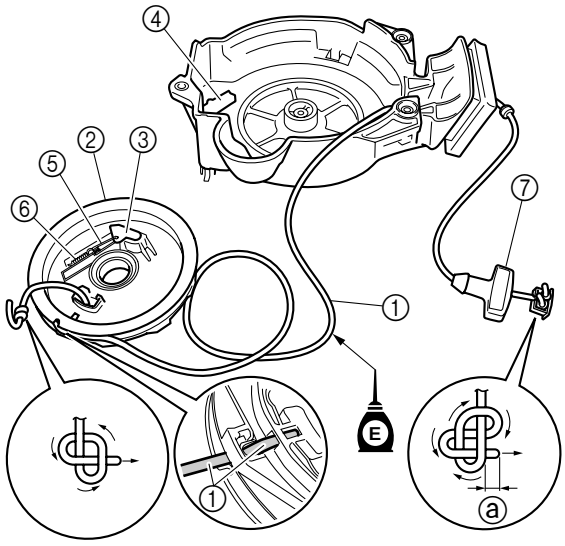
NOTE:
- When replacing the starter rope with a new one, make sure that the length is approximately 1,900 mm (74.8 in).
- Be sure to use a genuine Selva starter rope.

Assembling the manual starter

1. Install the starter rope ① into the sheave drum ②.

2. Install the drive pawl ③, starter plunger ④, drive pawl spring 2 ⑤, spring ⑥, and E-clip.

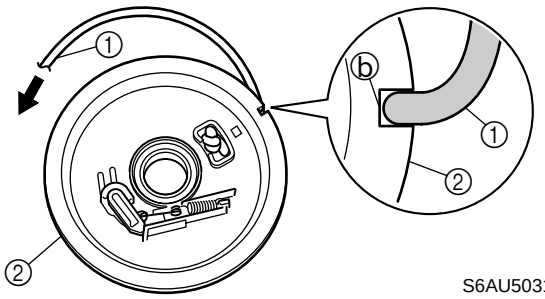
3. Install the starter handle ⑦.



S6AU5030

NOTE:
- Tie a knot at the end of the starter rope as shown in the illustration.
- Be sure to leave 12–20 mm (0.47–0.79 in) ⓐ at the end of the starter rope.

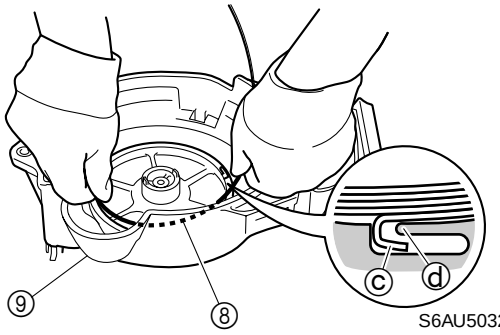
4. Wind the starter rope ① twice around the sheave drum ② in the direction of the arrow shown.



S6AU5031

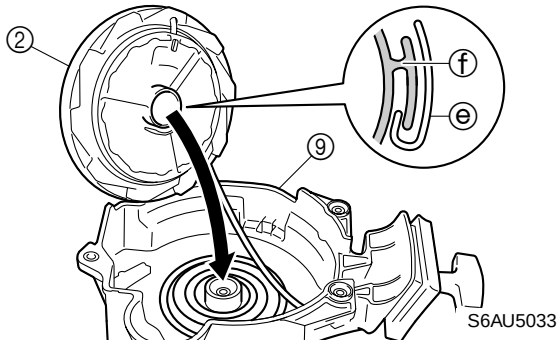
NOTE:
After winding the starter rope ① around the sheave drum ②, install the starter rope in the notch ⓑ.

5. Install the spiral spring ⑧ into the manual starter cover ⑨.



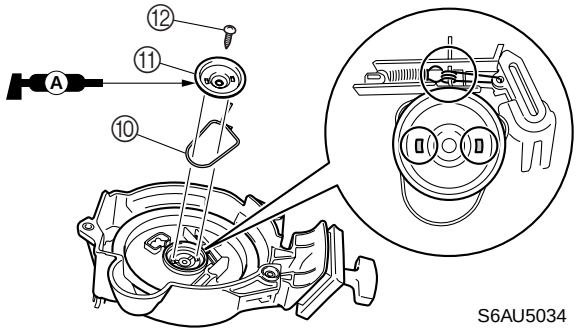
NOTE:
Hook the end ⓒ of the spiral spring ⑧ onto the cut-out ⓓ in the manual starter cover ⑨.

6. Install the sheave drum ② into the manual starter cover ⑨.



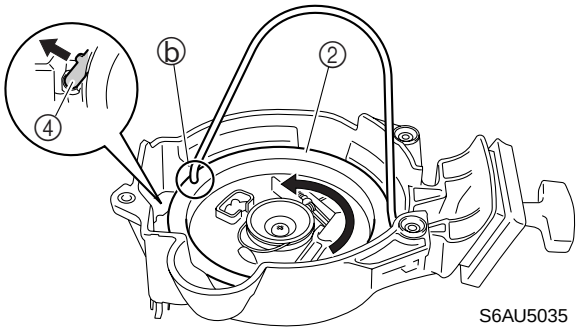
NOTE:
- When installing the sheave drum, set the spiral spring by turning the sheave drum.
- Hook the end ⓔ of the spiral spring ⑧ onto the cut-out ⓕ in the sheave drum ②.

7. Install drive pawl spring 1 ⑩, the drive plate ⑪, and the screw ⑫.



	Drive plate screw ⑫: 5 N·m (0.5 kgf·m, 3.7 ft·lb)

8. Turn the sheave drum ② 4 turns in the direction of the arrow shown.

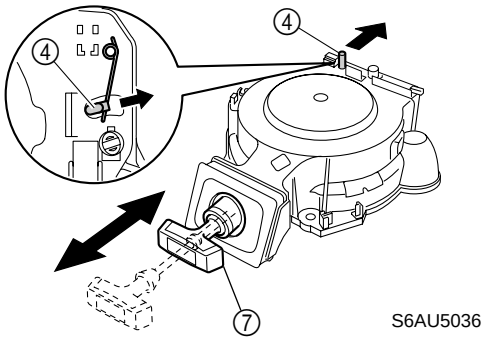


NOTE:
Hold the starter plunger ④ while turning the sheave drum as shown.

9. Remove the starter rope from the notch ⓑ, and then fit it into the groove in the sheave drum.

NOTE:
- Be sure to hold the sheave drum with your hand so that it turns slowly.
- Allow the spring force to slowly turn the drum as the starter rope winds around the drum.

10. Pull the starter handle ⑦ several times to check that the sheave drum turns smoothly and to check the starter rope for slack. Repeat steps 4–9 if necessary.



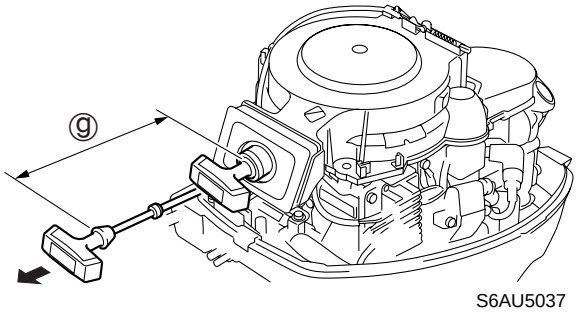
NOTE:
Hold the starter plunger ④ while pulling the starter handle ⑦.

5

11. Install the manual starter onto the power unit, and then connect the start-in-gear protection cable.

NOTE:
- Route the start-in-gear protection cable in its original position.
- To adjust the start-in-gear protection cable, see “Checking the start-in-gear protection (M model)” (3-11).

12. Pull the starter handle to extend the starter rope completely, and then measure the starter rope length ⓖ.

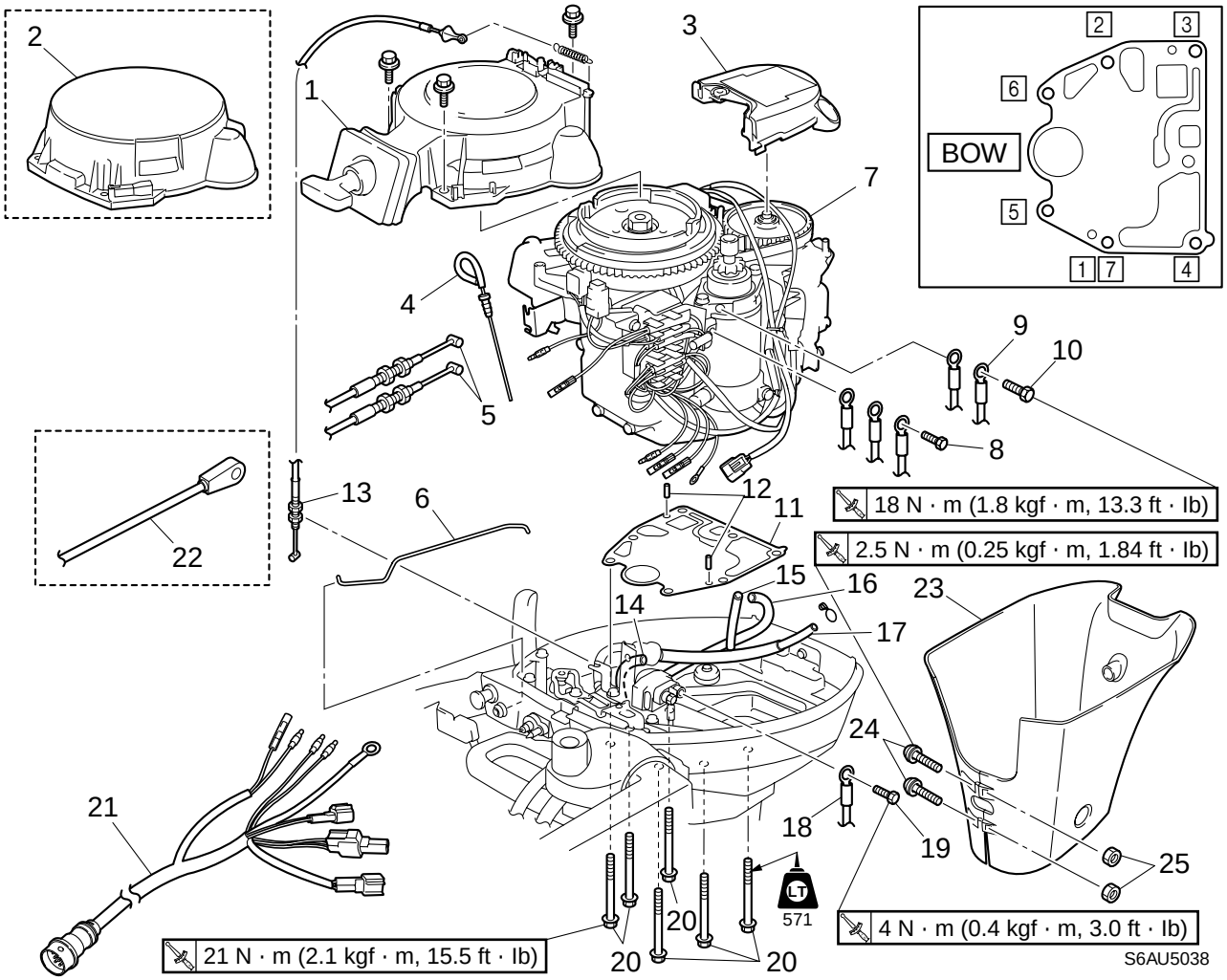


S6AU5037

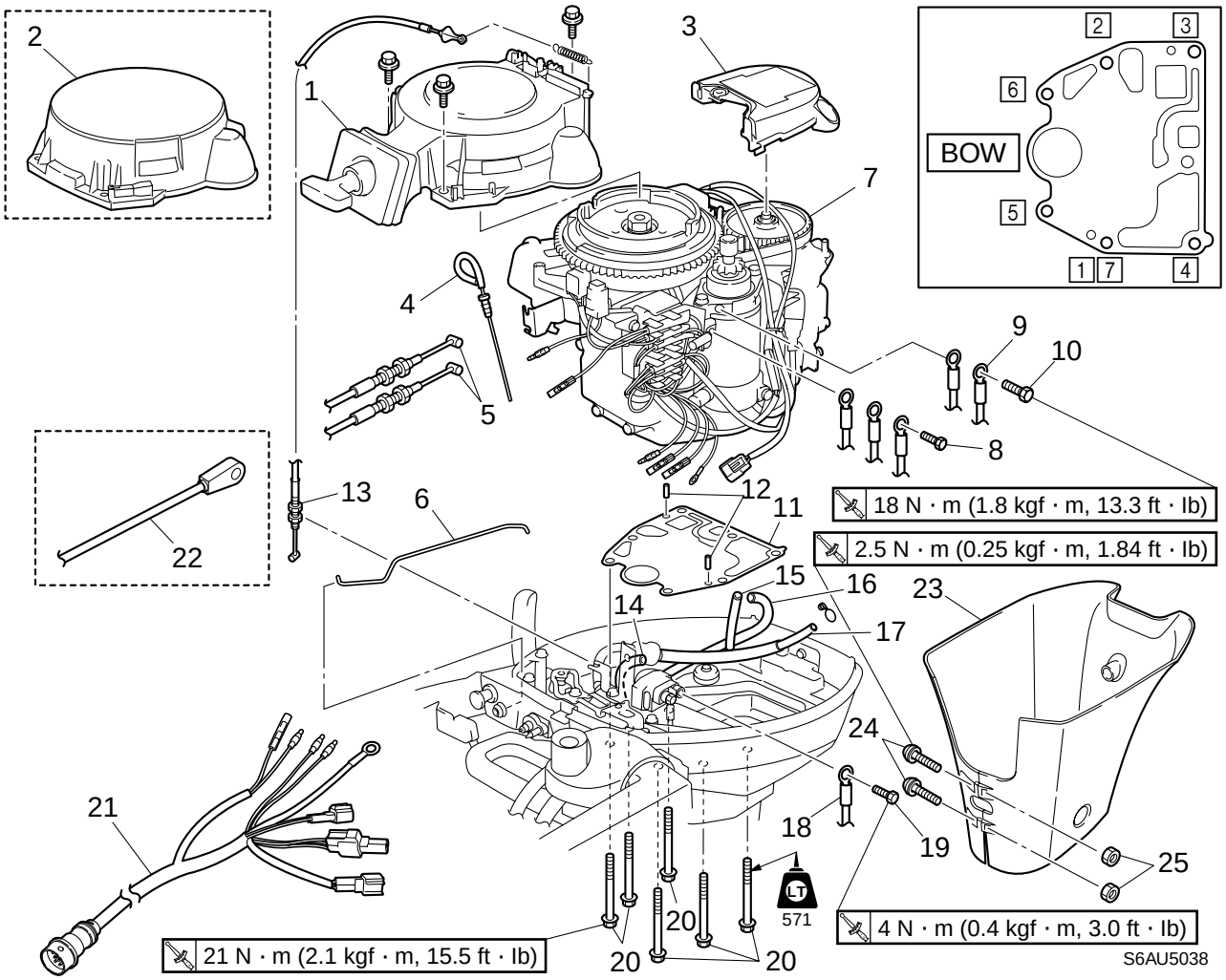
Starter rope pulling length ⓖ:
1,400–1,600 mm (55.12–62.99 in)

Power unit

Power unit assembly

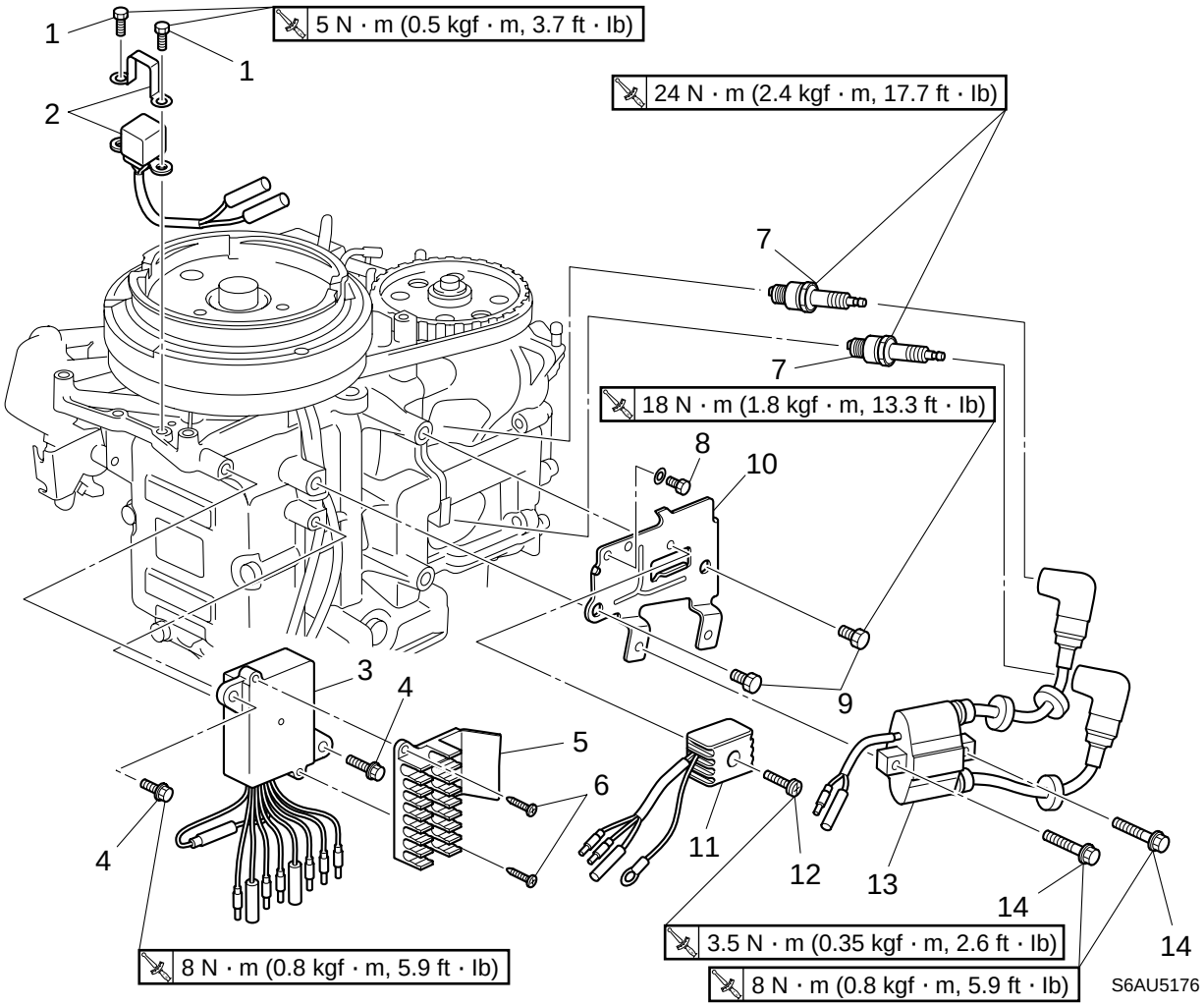


No.	Part name	Q'ty	Remarks
1	Manual starter	1	M model
2	Flywheel magnet cover	1	E model
3	Driven sprocket cover	1	
4	Oil dipstick	1	
5	Throttle cable	2	H model
6	Choke rod	1	
7	Power unit	1	
8	Bolt	1	M6 × 12 mm
9	Negative battery cable	1	E model
10	Bolt	1	M8 × 16 mm/E model
11	Gasket	1	**Not reusable**
12	Dowel	2	
13	Start-in-gear protection cable	1	M model
14	Cooling water hose	1	
15	Cooling water hose	1	
16	Flushing hose	1	For Europe
17	Fuel hose	1	



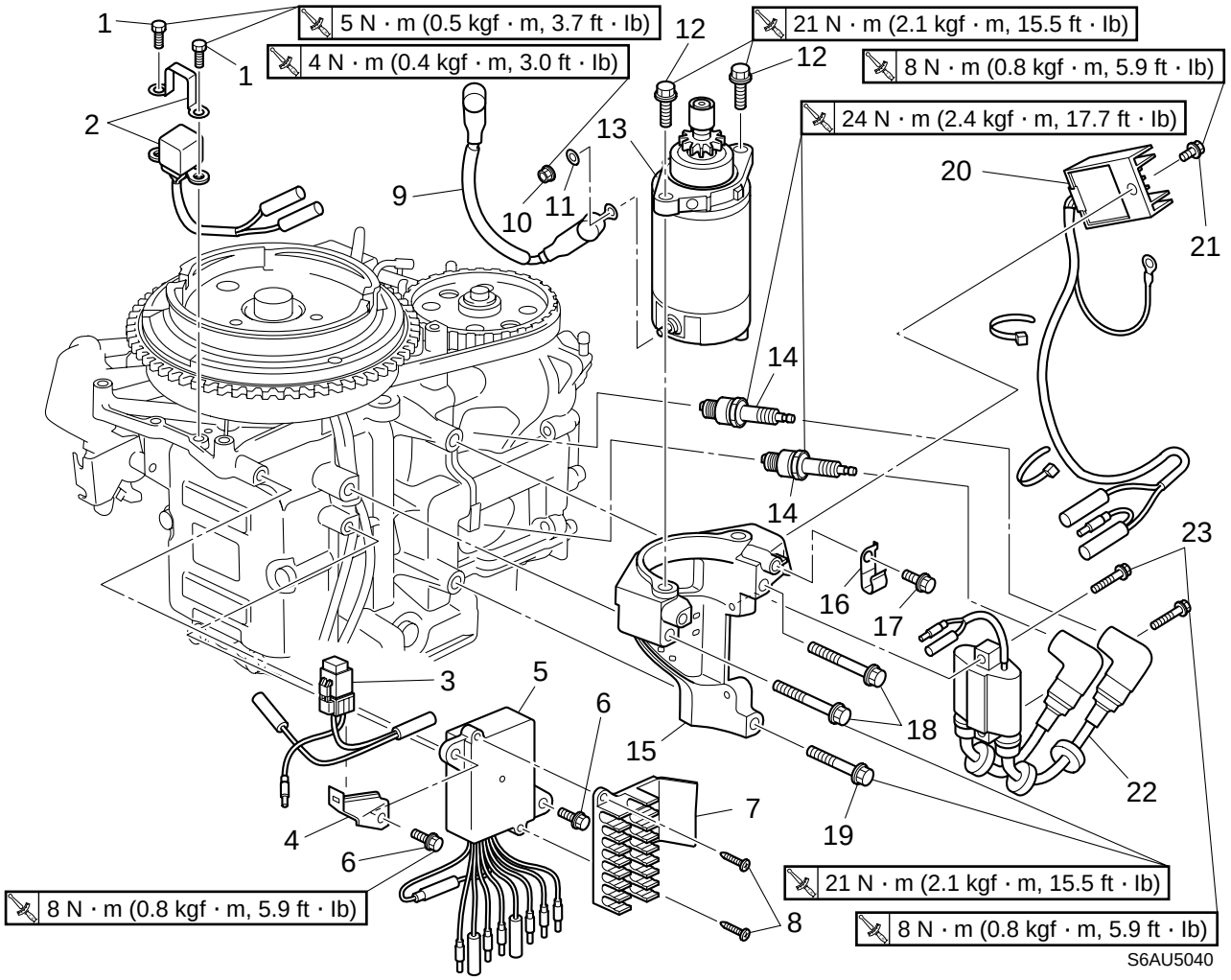
No.	Part name	Q'ty	Remarks
18	Starter motor lead	1	E model
19	Bolt	1	M6 × 10 mm/E model
20	Bolt	6	M8 × 75 mm
21	10-pin coupler harness	1	R model
22	Throttle cable	1	R model
23	Apron	1	
24	Screw	2	ø6 × 30 mm
25	Nut	2	

Ignition coil, CDI unit, and Rectifier (M model)

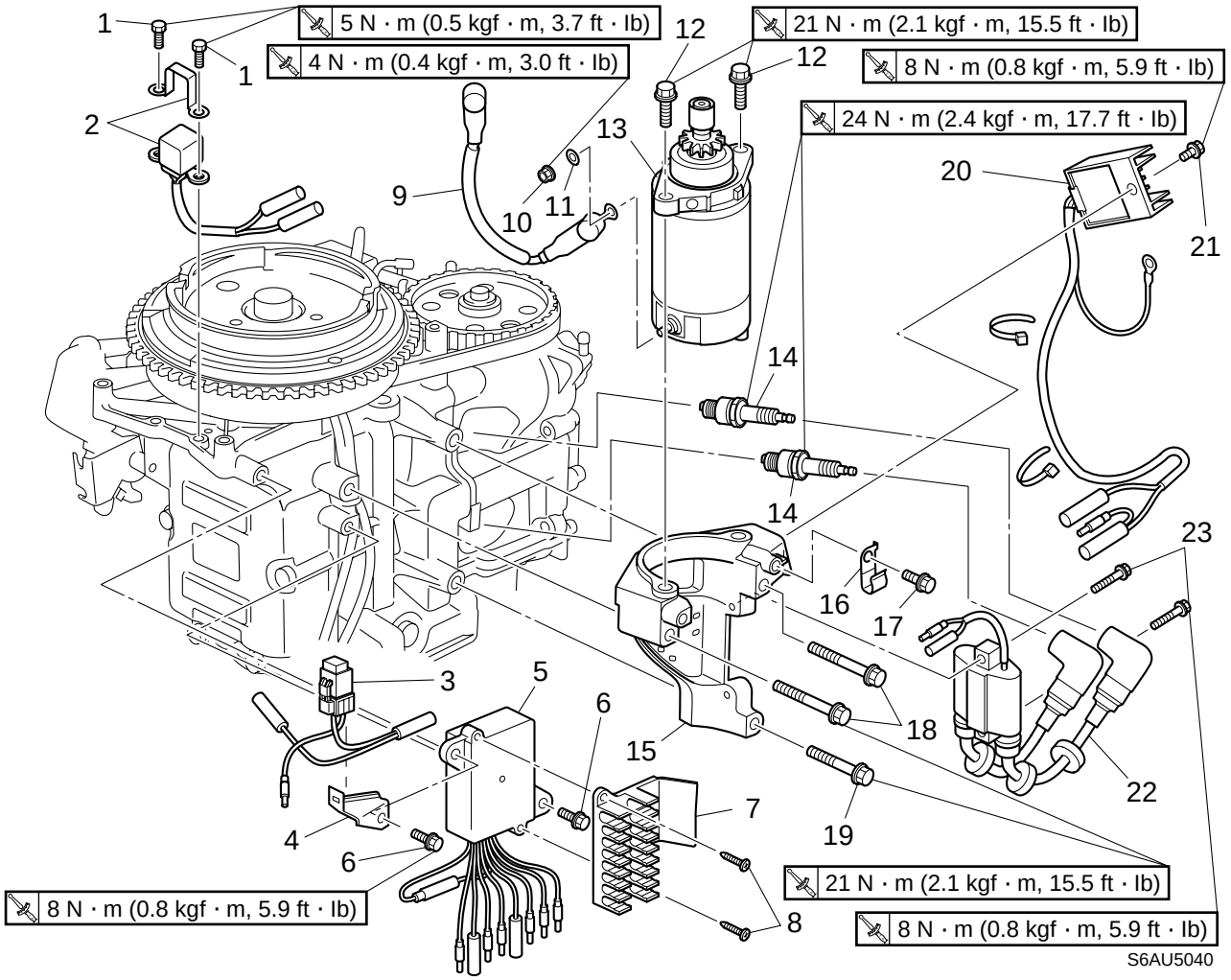

5 N · m (0.5 kgf · m, 3.7 ft · lb)
24 N · m (2.4 kgf · m, 17.7 ft · lb)
18 N · m (1.8 kgf · m, 13.3 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
3.5 N · m (0.35 kgf · m, 2.6 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
S6AU5176

No.	Part name	Q'ty	Remarks
1	Bolt	2	M5 × 10 mm
2	Pulser coil	1	
3	CDI unit	1	
4	Bolt	2	M6 × 20 mm
5	Junction box	1	
6	Screw	2	ø4 × 11 mm
7	Spark plug	2	
8	Bolt	1	M6 × 12 mm
9	Bolt	2	M8 × 12 mm
10	Bracket	1	
11	Rectifier	1	
12	Screw	1	ø5 × 25 mm
13	Ignition coil	1	
14	Bolt	2	M6 × 25 mm

Ignition coil, CDI unit, and Rectifier Regulator (E model)

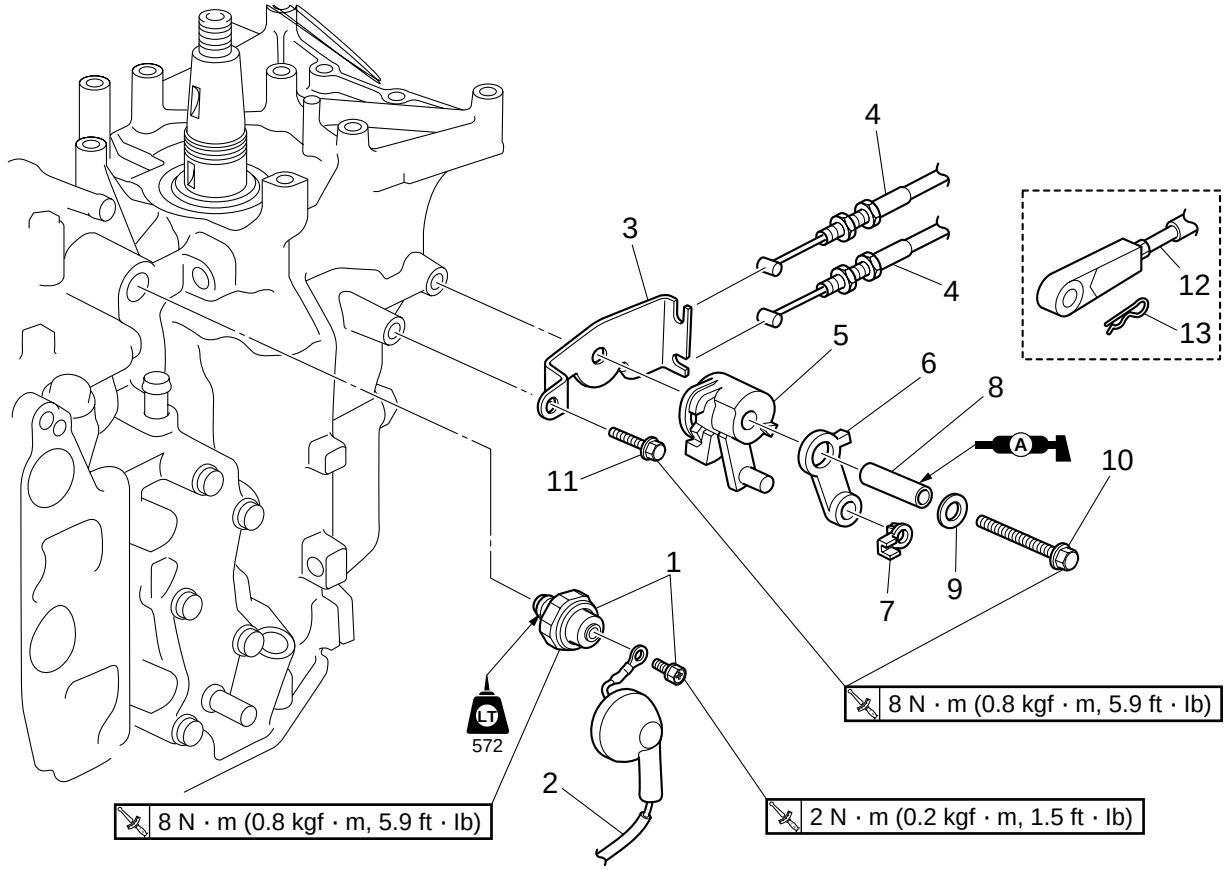

5 N · m (0.5 kgf · m, 3.7 ft · lb)
4 N · m (0.4 kgf · m, 3.0 ft · lb)
21 N · m (2.1 kgf · m, 15.5 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
24 N · m (2.4 kgf · m, 17.7 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
21 N · m (2.1 kgf · m, 15.5 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
S6AU5040

No.	Part name	Q'ty	Remarks
1	Bolt	2	M5 × 10 mm
2	Pulser coil	1	
3	Fuse holder assembly	1	
4	Fuse holder bracket	1	
5	CDI unit	1	
6	Bolt	2	M6 × 20 mm
7	Junction box	1	
8	Screw	2	ø4 × 11 mm
9	Starter motor lead	1	
10	Nut	1	
11	Washer	1	
12	Bolt	2	M8 × 25 mm
13	Starter motor	1	
14	Spark plug	2	
15	Starter motor bracket	1	
16	Holder	1	
17	Bolt	1	M6 × 12 mm


5 N · m (0.5 kgf · m, 3.7 ft · lb)
4 N · m (0.4 kgf · m, 3.0 ft · lb)
21 N · m (2.1 kgf · m, 15.5 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
24 N · m (2.4 kgf · m, 17.7 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
21 N · m (2.1 kgf · m, 15.5 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
S6AU5040

No.	Part name	Q'ty	Remarks
18	Bolt	2	M8 × 55 mm
19	Bolt	1	M8 × 40 mm
20	Rectifier Regulator	1	
21	Bolt	1	M6 × 12 mm
22	Ignition coil	1	
23	Bolt	2	M6 × 25 mm

Throttle cam and oil pressure switch



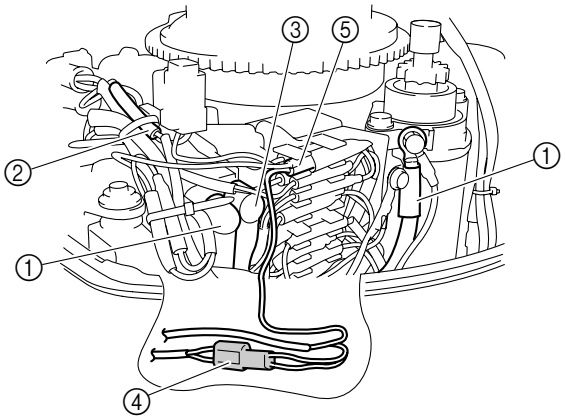
S6AU5045

No.	Part name	Q'ty	Remarks
1	Oil pressure switch	1	
2	Oil pressure switch lead	1	
3	Throttle cable bracket	1	
4	Throttle cable	2	H model
5	Throttle cam	1	
6	Free accel lever	1	
7	Clip	1	
8	Collar	1	
9	Washer	1	
10	Bolt	1	M6 × 45 mm
11	Bolt	1	M6 × 12 mm
12	Throttle cable	1	R model
13	Clip	1	R model

Removing the power unit

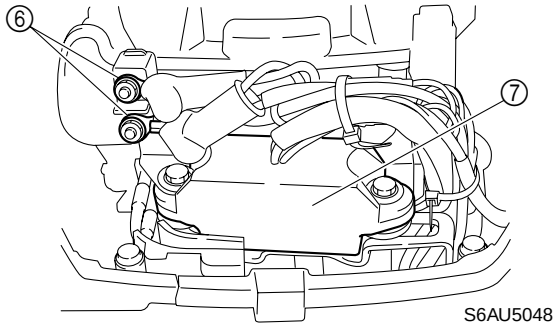
1. Disconnect the start-in-gear protection cable, and then remove the driven sprocket cover and manual starter. (M model)
   Remove the driven sprocket cover and flywheel magnet cover. (E model)

2. Disconnect the battery cables ①, battery lead ②, and starter motor lead ③. (E model)



S6AU5047

3. Disconnect the PT switch coupler ④, PT switch lead (R) ⑤, and PT relay lead (G, L) ⑥, and remove the PT relay ⑦. (PT model)

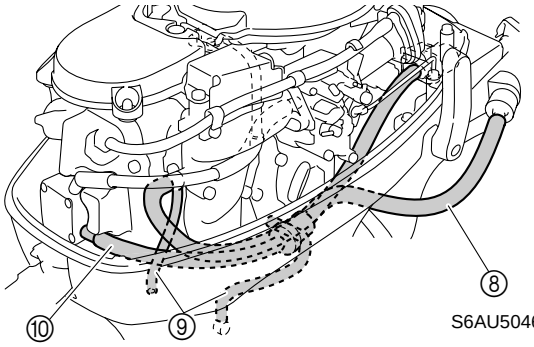


S6AU5048

4. Disconnect the engine shut-off switch leads, oil pressure warning indicator leads, and engine start button leads. (H model)
   Disconnect the 10-pin main harness from the power unit. (R model)

NOTE:
To disconnect the leads, see “Electrical component and wiring harness routing” (8-1).

5. Disconnect the flushing hose ⑧ (for Europe), cooling water hoses ⑨, and fuel hose ⑩.

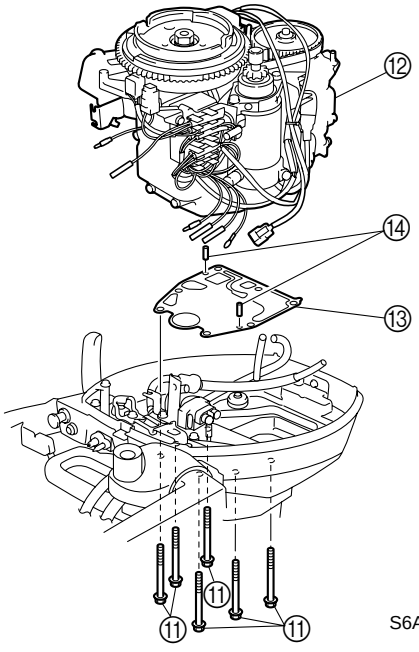


S6AU5046

6. Disconnect the throttle cables from the throttle cam. (H model)
   Disconnect the throttle cable joint from the throttle cam. (R model)

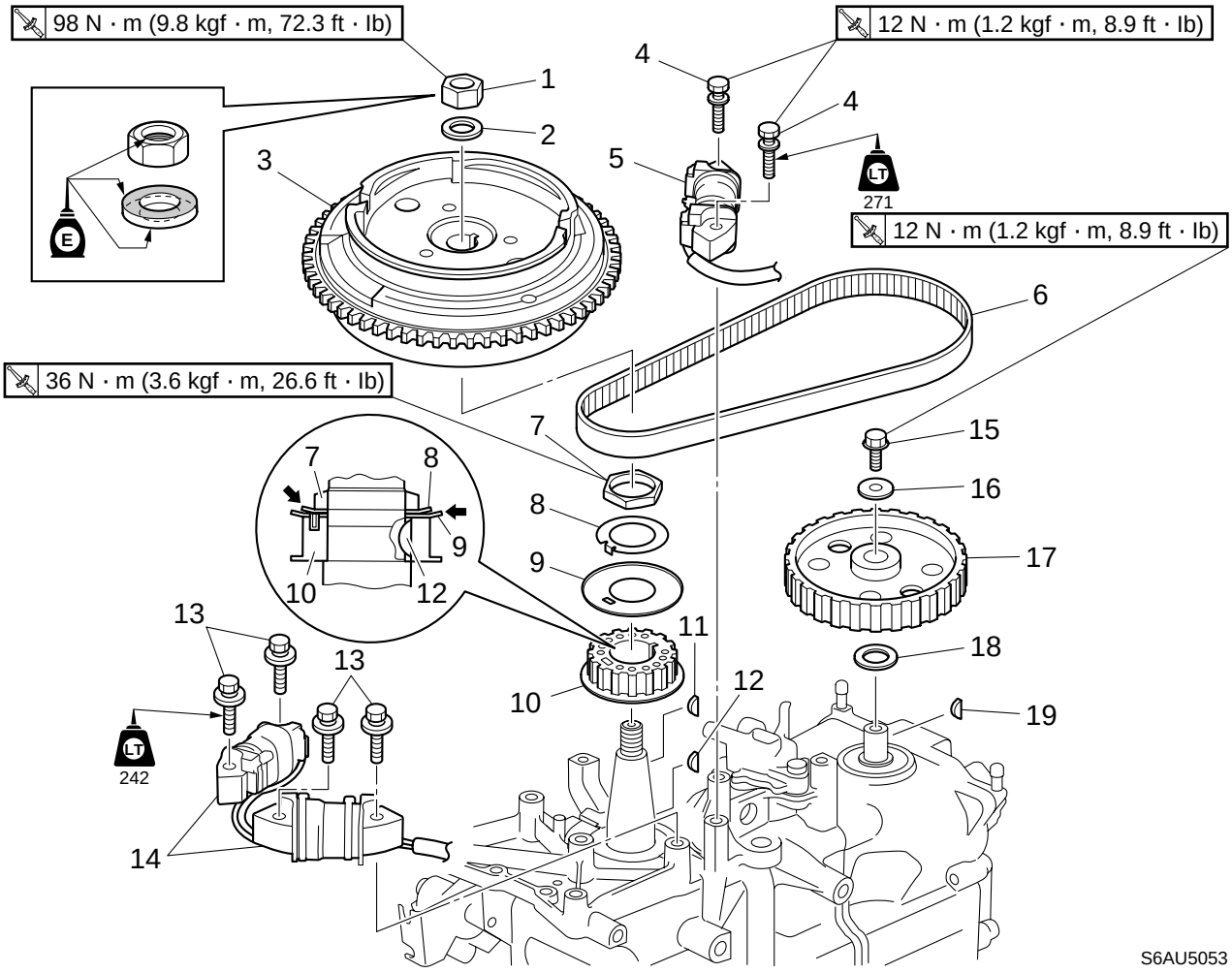
7. Remove the choke rod, dipstick, and apron, and then remove the mounting bolts ⑪.

8. Remove the power unit ⑫, gasket ⑬, and dowels ⑭.

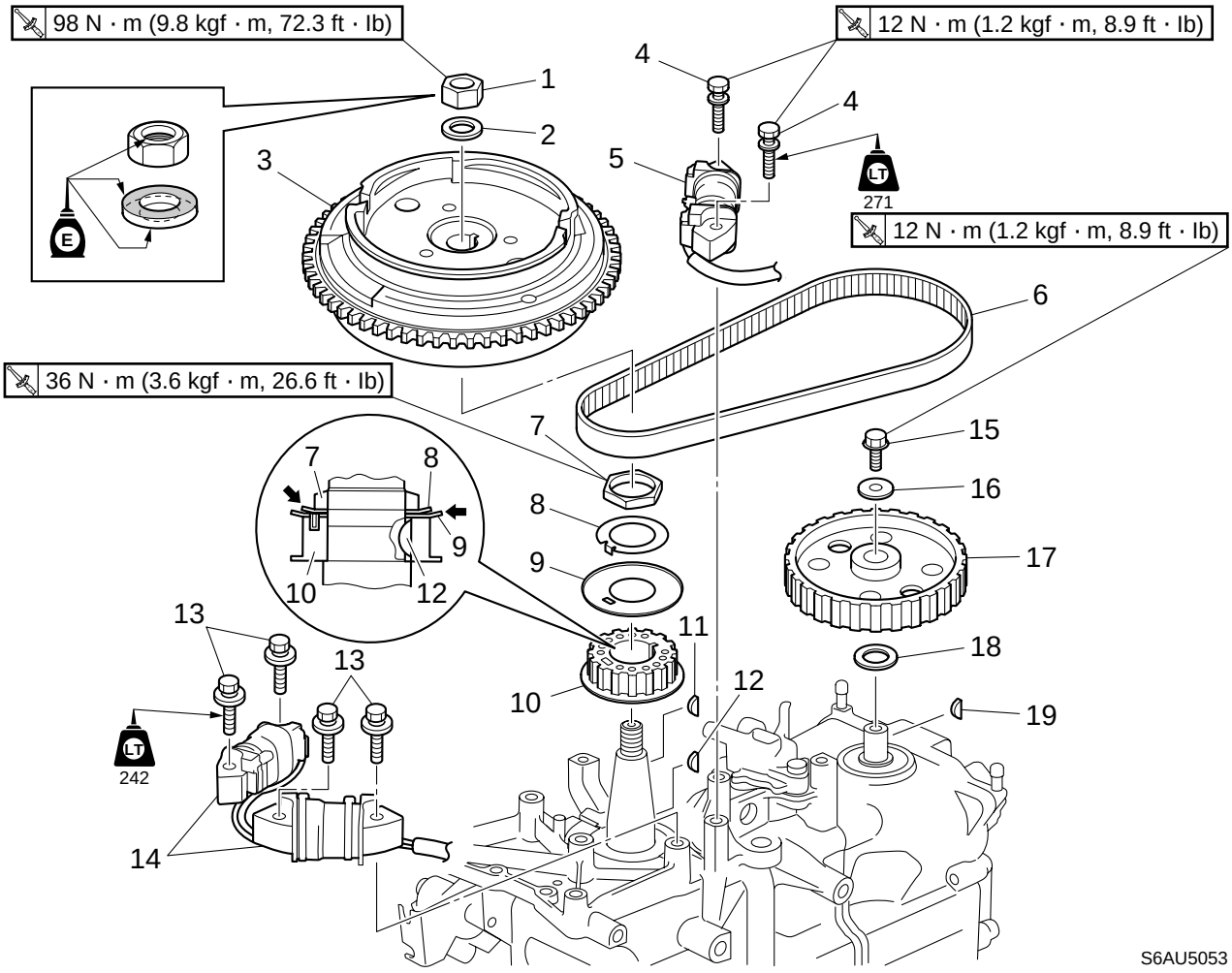


S6AU5052

Timing belt and sprocket



No.	Part name	Q'ty	Remarks
1	Nut	1	Width across flats: 22 mm
2	Washer	1	
3	Flywheel magnet	1	
4	Bolt	2	M6 × 25 mm
5	Charge coil	1	
6	Timing belt	1	
7	Nut	1	Width across flats: 30 mm
8	Lock washer	1	
9	Retaining plate	1	
10	Drive sprocket	1	
11	Woodruff key	1	
12	Woodruff key	1	
13	Bolt	4	M6 × 30 mm
14	Lighting coil	2	
15	Bolt	1	M6 × 14 mm
16	Washer	1	
17	Driven sprocket	1	



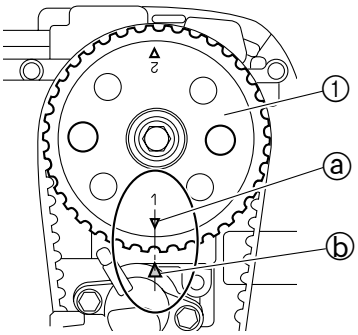
No.	Part name	Q'ty	Remarks
18	Washer	1	
19	Woodruff key	1	

Removing the timing belt and sprocket

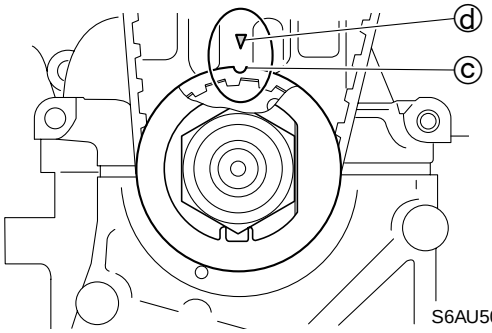
1. Remove the flywheel magnet, charge coil, and lighting coil(s).

NOTE:
See "Replacing the timing belt" (5-3).

2. Align the "1 ▲" mark ⓐ on the driven sprocket ① with the "▲" mark ⓑ on the thermostat cover.



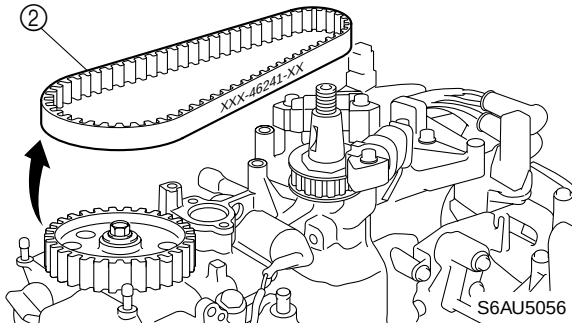
S6AU5054



S6AU5055

NOTE:
Check that the notch ⓒ in the drive sprocket and the "▲" mark ⓓ on the cylinder block are aligned.

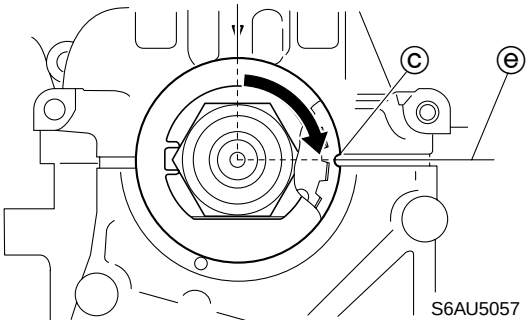
3. Remove the timing belt ② from the driven sprocket, and then remove it from the drive sprocket.



S6AU5056

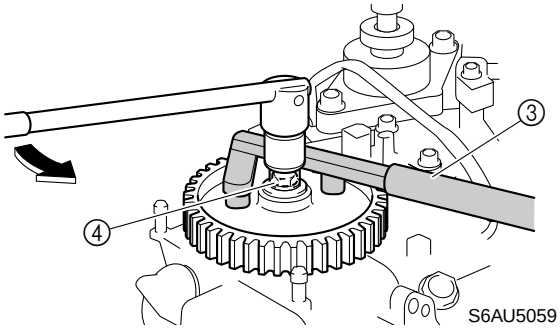
CAUTION:
Unless directed to do so in the following instructions, do not turn the drive sprocket or driven sprocket when the timing belt is not installed. Otherwise the pistons and valves will collide with each other and be damaged.

4. Align the notch ⓒ in the drive sprocket with the mating surface ⓔ of the crankcase and cylinder block by turning the crankshaft clockwise approximately 90° gradually.



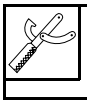
S6AU5057

5. Hold the driven sprocket using the special service tool ③, and then remove the driven sprocket bolt ④.



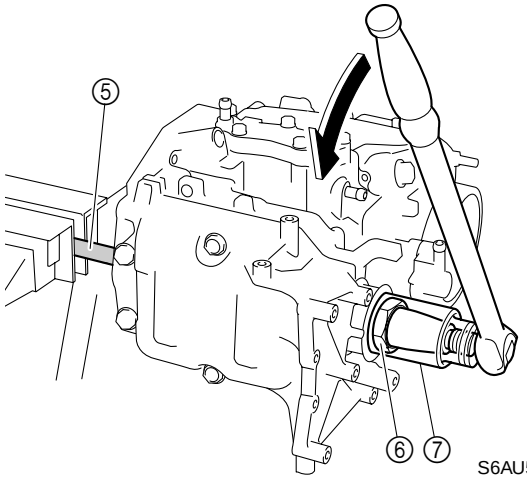
S6AU5059

NOTE:
Make sure that the driven sprocket does not turn when loosening the driven sprocket bolt.

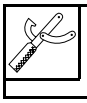
	Flywheel holder ③: 90890-06522

6. Remove the driven sprocket and Woodruff key.

7. Install the power unit to the special service tool ⑤ as shown, and then remove the drive sprocket nut ⑥.



NOTE:
Use a deep 30 mm socket ⑦ to loosen the drive sprocket nut ⑥.

	Shaft holder ⑤: 90890-06561

8. Remove the lock washer, retaining plate, drive sprocket, and Woodruff key.

Checking the timing belt and sprocket

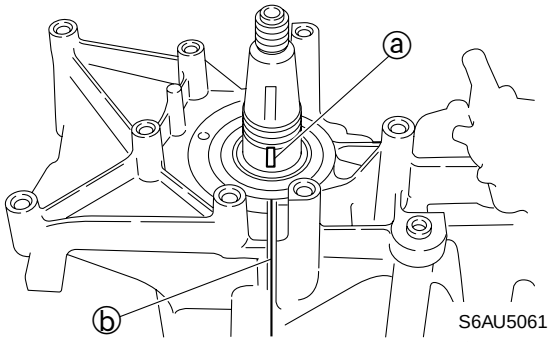
1. Check the interior and exterior of the timing belt. Replace if cracked, damaged, or worn.

2. Check the drive sprocket and driven sprocket. Replace if cracked, damaged, or worn.

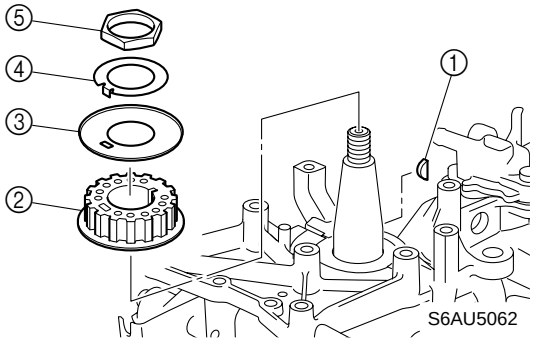
Installing the sprocket and timing belt

CAUTION:
Unless directed to do so in the following instructions, do not turn the crankshaft or camshaft when the timing belt is not installed. Otherwise the pistons and valves will collide with each other and be damaged.

1. Align the keyway ⓐ in the crankshaft with the mating surface ⓑ of the crankcase and cylinder block.

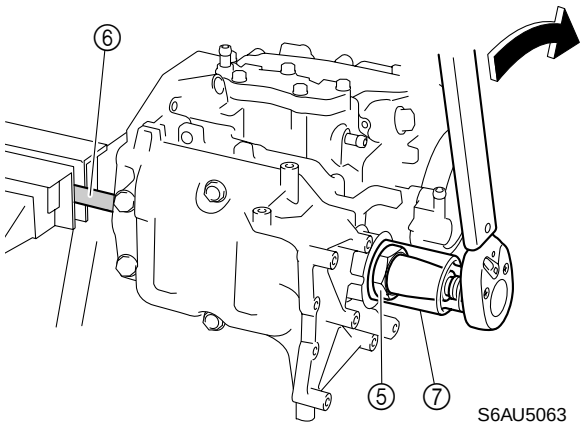


2. Install the Woodruff key ①, drive sprocket ②, retaining plate ③, and lock washer ④, and then install the drive sprocket nut ⑤ temporarily.



5

3. Install the power unit to the special service tool ⑥, and then tighten the drive sprocket nut ⑤ to the specified torque.

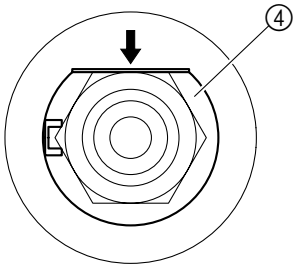


NOTE:
Use a deep 30 mm socket ⑦ to tighten the drive sprocket nut.

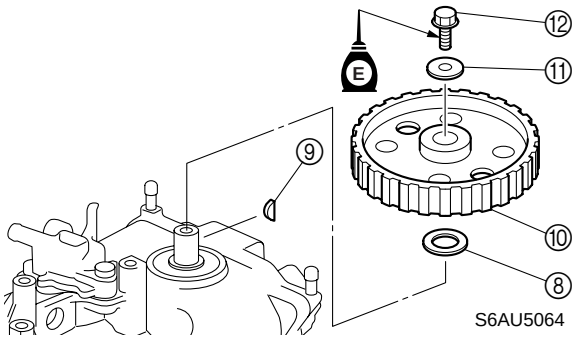
	Shaft holder ⑥: 90890-06561

	Drive sprocket nut ⑤: 36 N·m (3.6 kgf·m, 26.6 ft·lb)

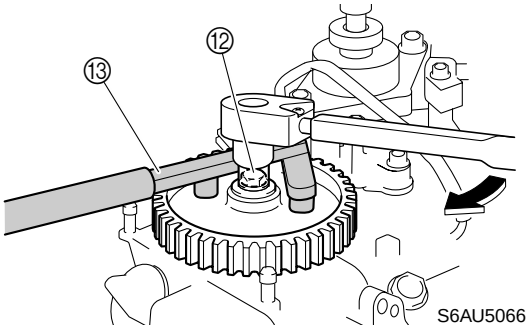
4. Bend the lock washer ④ along a flat side of the nut.



5. Install the washer ⑧, Woodruff key ⑨, driven sprocket ⑩, and washer ⑪, and then install the driven sprocket bolt ⑫ temporarily.



6. Hold the driven sprocket using the special service tool ⑬, and then tighten the driven sprocket bolt ⑫ to the specified torque.

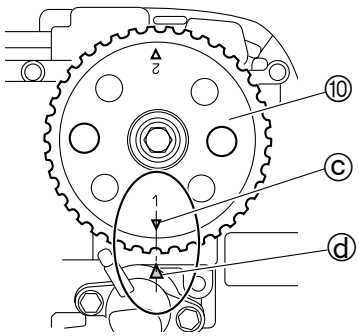


NOTE:
Make sure that the driven sprocket does not turn when tightening the driven sprocket bolt.

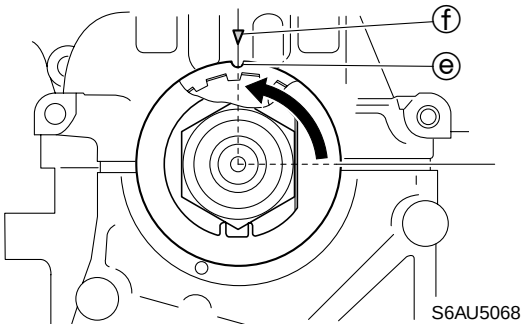
	Flywheel holder ⑬: 90890-06522

	Driven sprocket bolt ⑫: 12 N·m (1.2 kgf·m, 8.9 ft·lb)

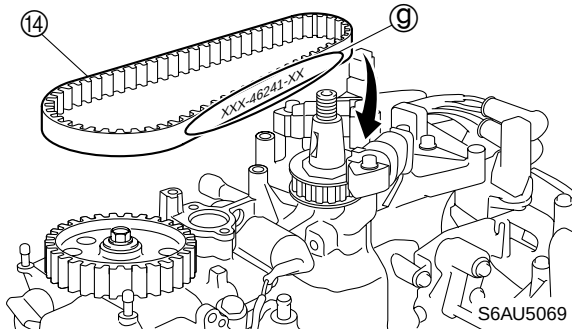
7. Align the "1 ▲" mark ⓒ on the driven sprocket ⑩ with the "▲" mark ⓓ on the thermostat cover.



8. Align the notch ⓔ in the drive sprocket with the "▲" mark ⓕ on the cylinder block by turning the crankshaft counterclockwise approximately 90° gradually.



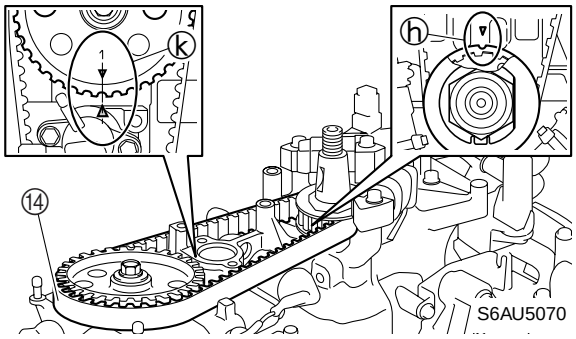
9. Install the timing belt ⑭ onto the drive sprocket, and then install it onto the driven sprocket with its part number ⓖ in the upright position.



CAUTION:

- **Do not twist, turn inside out, or bend the timing belt beyond the maximum limit of 25 mm (1.0 in), otherwise it can be damaged.**
- **Do not get oil or grease on the timing belt.**

10. Turn the drive sprocket clockwise 2 turns, and then check that the parts are aligned at the areas ⓗ and ⓚ as shown.



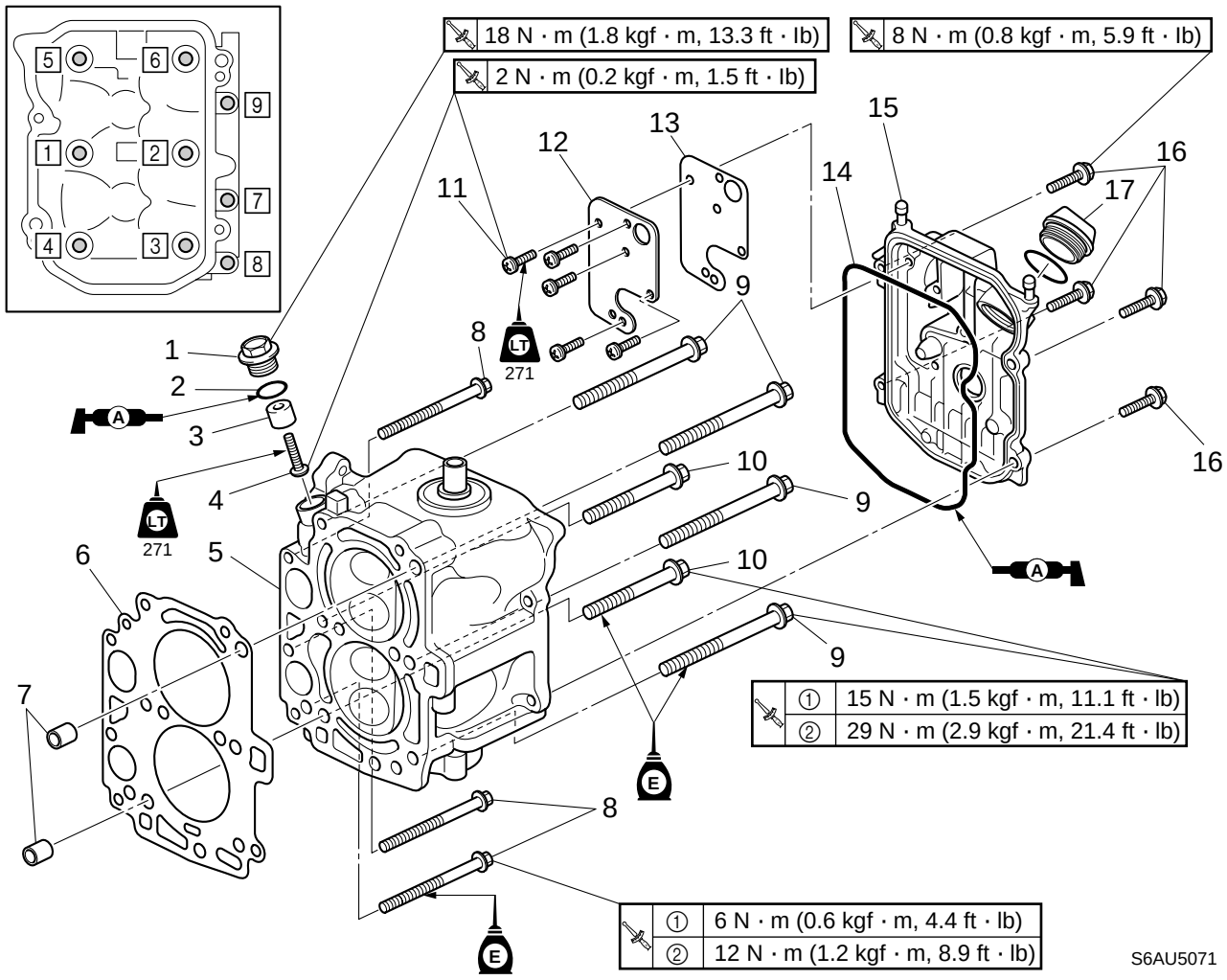
11. Install the charge coil, lighting coil(s), and flywheel magnet.

NOTE:

See "Replacing the timing belt" (5-3).

5

Cylinder head


18 N · m (1.8 kgf · m, 13.3 ft · lb)
2 N · m (0.2 kgf · m, 1.5 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
15 N · m (1.5 kgf · m, 11.1 ft · lb)
29 N · m (2.9 kgf · m, 21.4 ft · lb)
6 N · m (0.6 kgf · m, 4.4 ft · lb)
12 N · m (1.2 kgf · m, 8.9 ft · lb)
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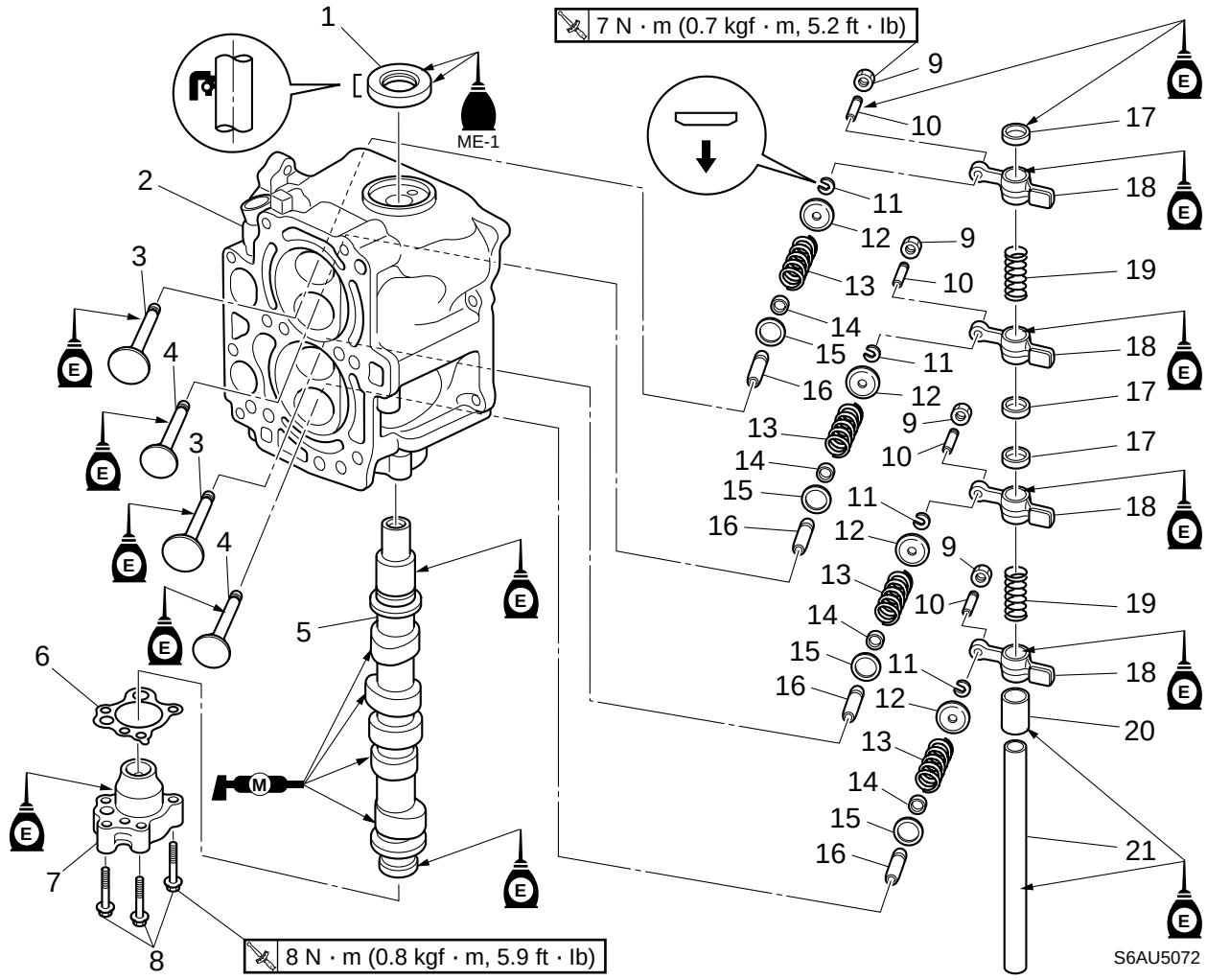
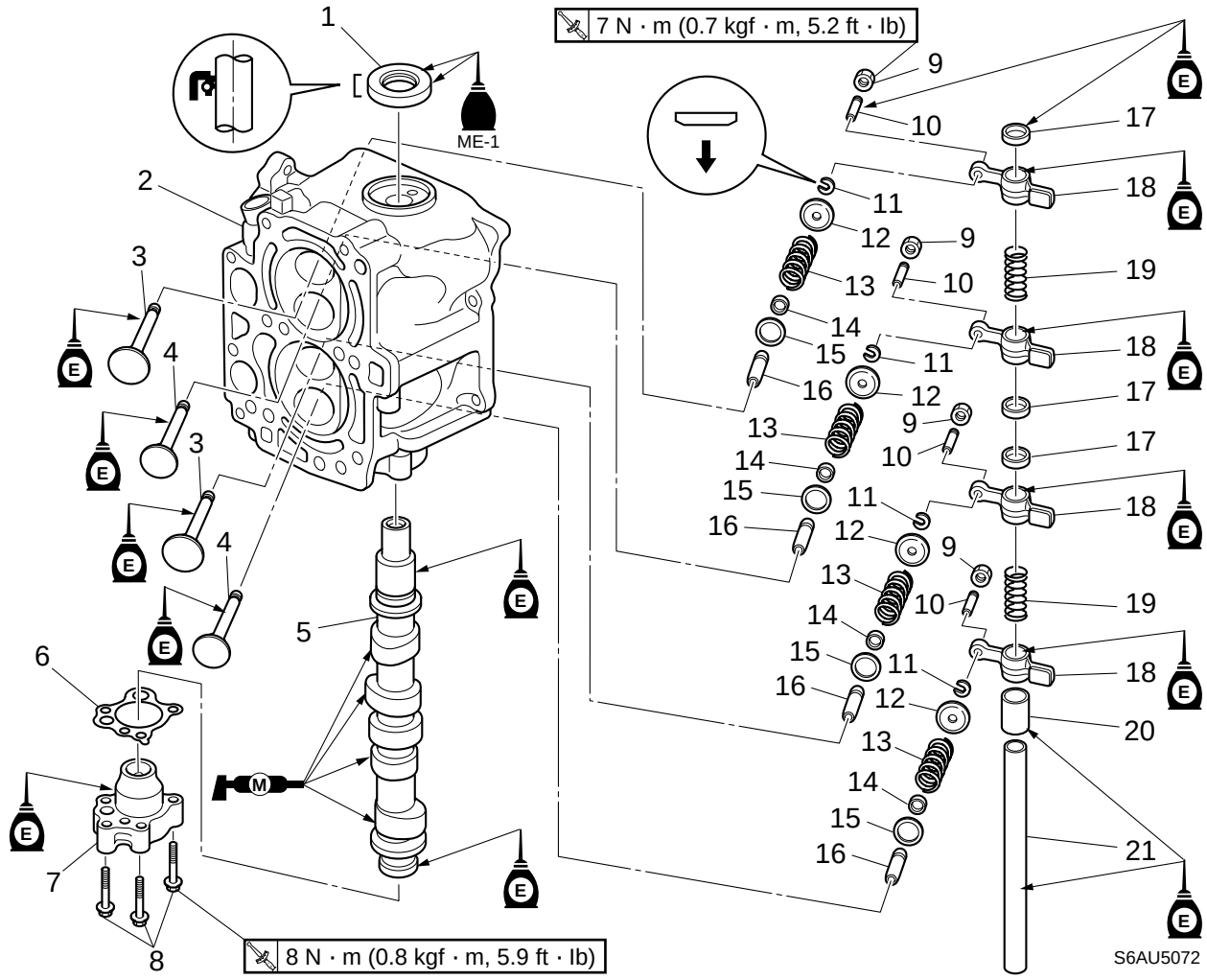
S6AU5071

No.	Part name	Q'ty	Remarks
1	Plug	1	
2	O-ring	1	**Not reusable**
3	Anode	1	
4	Screw	1	ø5 × 24 mm
5	Cylinder head assembly	1	
6	Gasket	1	**Not reusable**
7	Dowel	2	
8	Bolt	3	M6 × 70 mm
9	Bolt	4	M8 × 74 mm
10	Bolt	2	M8 × 60 mm
11	Screw	5	ø4 × 10 mm
12	Plate	1	
13	Gasket	1	**Not reusable**
14	Gasket	1	**Not reusable**
15	Cylinder head cover	1	
16	Bolt	4	M6 × 20 mm
17	Oil filler cap	1	



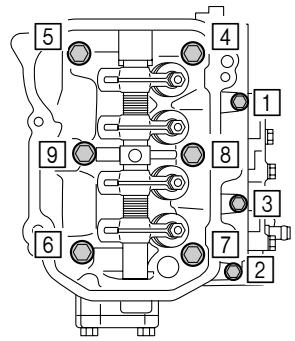
No.	Part name	Q'ty	Remarks
1	Oil seal	1	**Not reusable**
2	Cylinder head	1	
3	Intake valve	2	
4	Exhaust valve	2	
5	Camshaft	1	
6	Gasket	1	**Not reusable**
7	Oil pump assembly	1	
8	Bolt	3	M6 × 30 mm
9	Locknut	4	
10	Adjusting screw	4	
11	Valve cotter	4	
12	Valve spring retainer	4	
13	Valve spring	4	
14	Valve seal	4	**Not reusable**
15	Valve spring seat	4	
16	Valve guide	4	**Not reusable**
17	Collar	3	



No.	Part name	Q'ty	Remarks
18	Rocker arm	4	
19	Spring	2	
20	Collar	1	
21	Shaft	1	

Removing the cylinder head

1. Remove the cylinder head cover.
2. Remove the cylinder head bolts in the sequence shown.



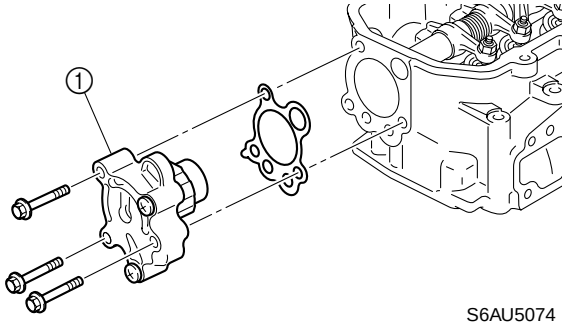
S6AU5073

CAUTION:

Do not scratch or damage the mating surfaces of the cylinder head and cylinder block.

Disassembling the cylinder head

1. Remove the oil pump assembly ①.

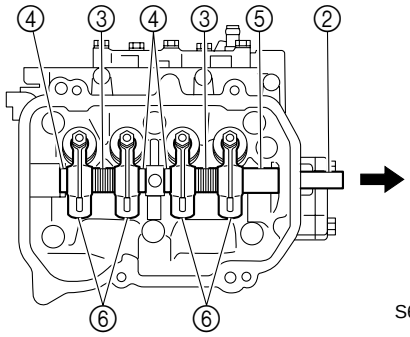


S6AU5074

NOTE:

To disassemble, check, and assemble the oil pump, see “Checking the oil pump” (5-37).

2. Pull out the rocker arm shaft ②, and then remove the springs ③, collars ④ and ⑤, and rocker arms ⑥.

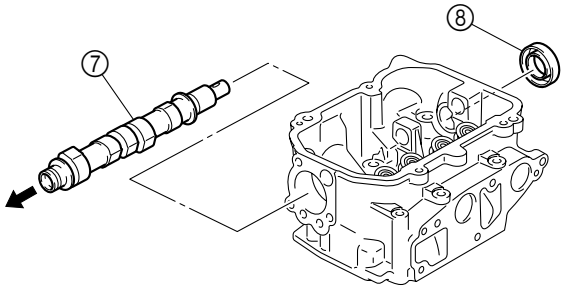


S6AU5075

NOTE:

- Loosen the locknuts and adjusting screws to ease the tension on the rocker arm shaft before pulling it out.
- Be sure to keep the parts in the order as they were removed.

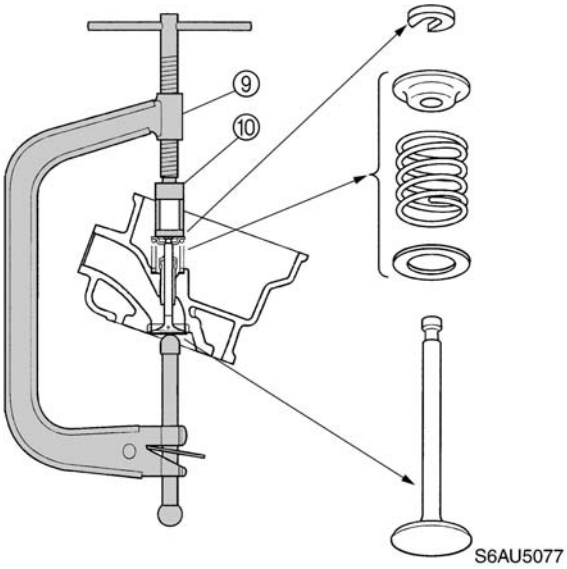
3. Remove the camshaft ⑦ and oil seal ⑧.



S6AU5076

5

4. Remove the intake and exhaust valves.



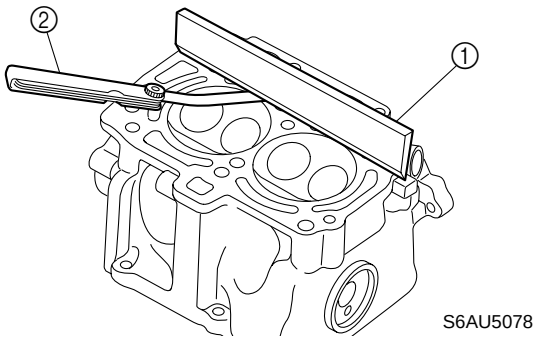
NOTE:
Be sure to keep the valves, springs, and other parts in the order as they were removed.

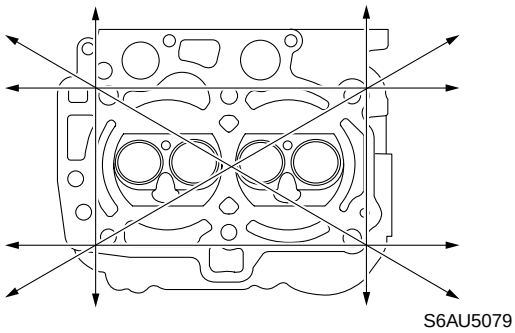
Valve spring compressor ⑨: 90890-04019
Valve spring compressor attachment ⑩: 90890-06320

Checking the cylinder head

1. Eliminate carbon deposits from the combustion chambers and check for deterioration.

2. Check the cylinder head warpage using a straightedge ① and thickness gauge ② in the directions shown. Replace the cylinder head assembly if above specification.

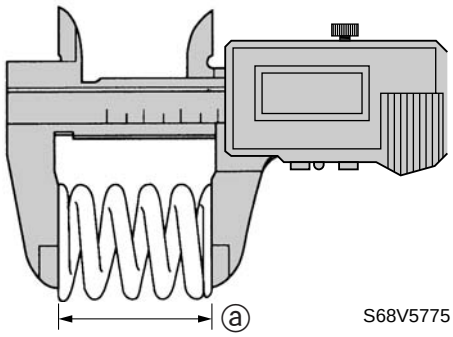




Cylinder head warpage limit: 0.10 mm (0.0039 in)

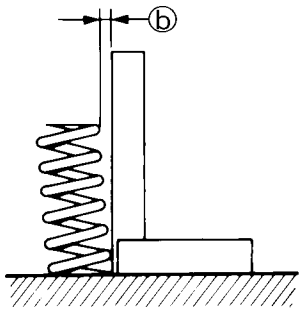
Checking the valve spring

1. Measure the valve spring free length ⓐ. Replace if below specification.



Valve spring free length ⓐ: 27.6 mm (1.0866 in)

2. Measure the valve spring tilt ⓑ. Replace if above specification.

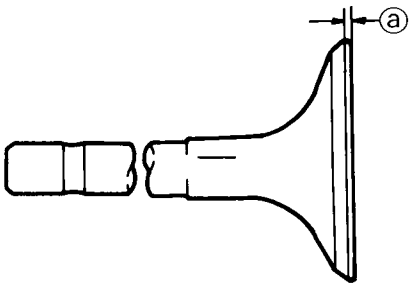


S69J5730

Valve spring tilt limit ⓑ:
1.0 mm (0.039 in)

Checking the valve

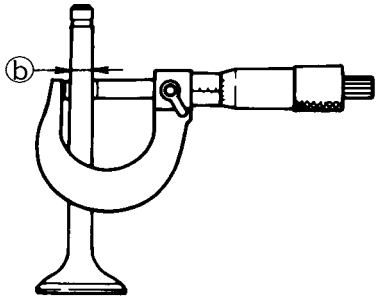
1. Check the valve face. Replace the valve if pitted or worn.
2. Measure the valve margin thickness ⓐ. Replace the valve if out of specification.



S69J5740

Valve margin thickness ⓐ:
Intake: 0.7 mm (0.028 in)
Exhaust: 1.0 mm (0.039 in)

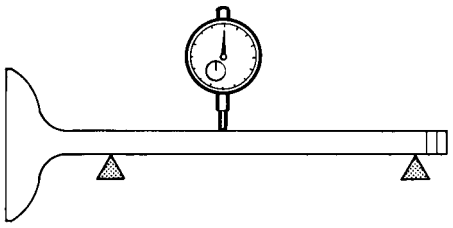
3. Measure the valve stem diameter ⓑ. Replace the valve if out of specification.



S69J5750

Valve stem diameter ⓑ:
Intake:
5.475–5.490 mm
(0.2156–0.2161 in)
Exhaust:
5.460–5.475 mm
(0.2150–0.2156 in)

4. Measure the valve stem runout. Replace the valve if above specification.

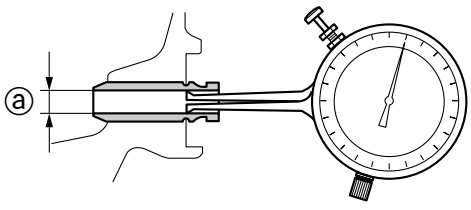

S69J5760

Valve stem runout limit:
0.01 mm (0.0004 in)

Checking the valve guide

NOTE:
Before checking a valve guide, make sure that the valve stem diameter is within specification.

1. Measure the valve guide inside diameter ⓐ.



S6AU5085

Valve guide inside diameter ⓐ:
Intake and exhaust:
5.500–5.512 mm
(0.2165–0.2170 in)

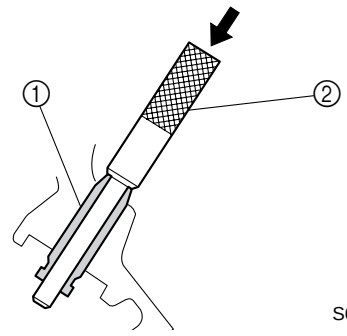
5

2. Calculate the valve-stem-to-valve-guide clearance as follows. Replace the valve guide if out of specification.

Valve-stem-to-valve-guide clearance = valve guide inside diameter – valve stem diameter:
Intake:
0.010–0.037 mm
(0.0004–0.0015 in)
Exhaust:
0.025–0.052 mm
(0.0010–0.0020 in)

Replacing the valve guide

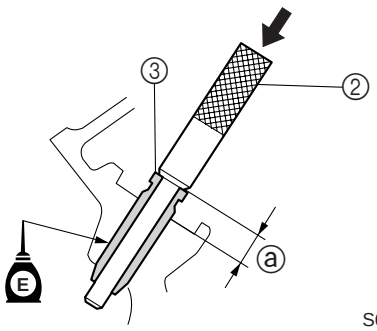
1. Remove the valve seal.
2. Remove the valve guide ① by striking the special service tool ② from the combustion chamber side.



S6AU5086

Valve guide remover/installer ②:
90890-06801

3. Install a new valve guide ③ using the special service tool ② from the camshaft side to the specified height ⓐ.



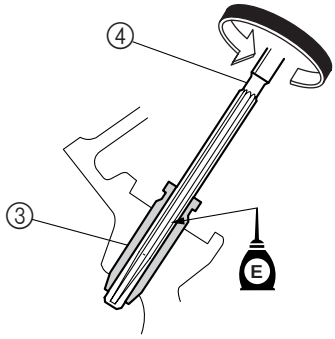
S6AU5087

NOTE:
Apply engine oil to the surface of a new valve guide ③ before installation.

Valve guide remover/installer ②:
90890-06801

Valve guide height ⓐ:
Intake and exhaust:
8.05 ± 0.25 mm (0.32 ± 0.01 in)

4. Insert the special service tool ④ into the valve guide ③, and then ream the valve guide.



S6AU5088

NOTE:
- Apply engine oil to the inner surface of the valve guide before reaming it.
- Turn the valve guide reamer clockwise to ream the valve guide.
- Do not turn the reamer counterclockwise when removing it.
- Be sure to clean the valve guide after reaming it.

Valve guide reamer ④: 90890-06804

5. Measure the valve guide inside diameter.

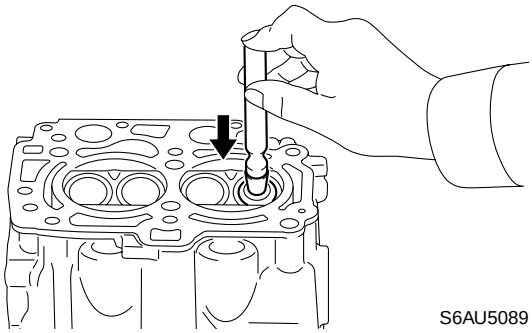
Valve guide inside diameter:
Intake and exhaust:
5.500–5.512 mm
(0.2165–0.2170 in)

Checking the valve seat

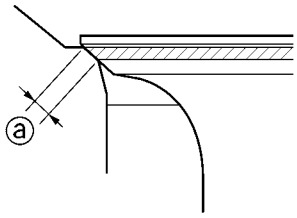
1. Eliminate carbon deposits from the valve.

2. Apply a thin, even layer of Mechanic's blueing dye (Dykem) onto the valve seat.

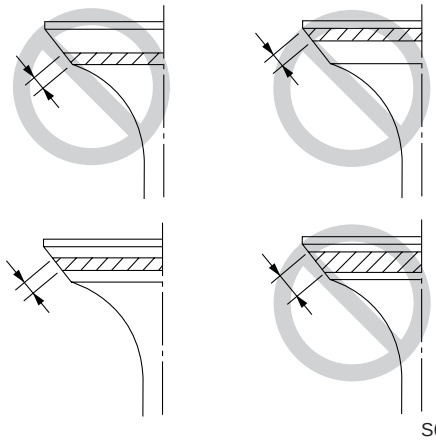
3. Press the valve lightly against the valve seat with a valve lapper as shown.


S6AU5089

4. Measure the valve seat contact width ⓐ where the blueing dye is adhered to the valve face. Reface the valve seat if the valve is not seated properly or if the valve seat contact width is out of specification. Check the valve guide if the valve seat contact is uneven.



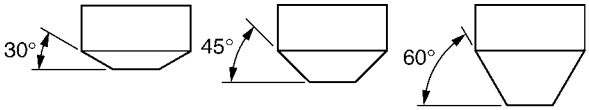
S69J5830


S68V5720

Valve seat contact width ⓐ:
Intake and exhaust:
0.6–0.8 mm (0.024–0.031 in)

Refacing the valve seat

1. Reface the valve seat with the valve seat cutters.

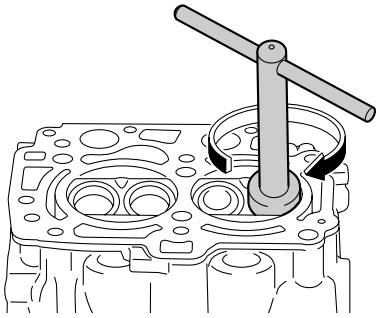


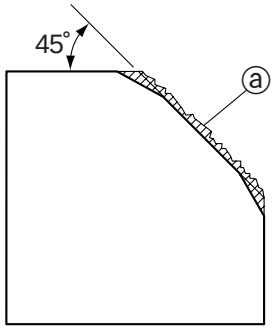
S69J5850

Valve seat cutter holder:
90890-06316
Valve seat cutter:
30° (intake): 90890-06328
30° (exhaust): 90890-06815
45° (intake): 90890-06312
45° (exhaust): 90890-06814
60° (intake): 90890-06315
60° (exhaust): 90890-06813

5

2. Cut the surface of the valve seat with a 45° cutter by turning the cutter clockwise until the valve seat face has become smooth.


S6AU5095



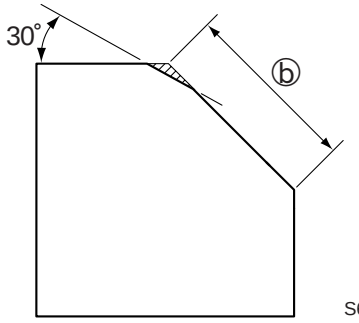
S6AG5J20J

ⓐ Slag or rough surface

CAUTION:

Do not over cut the valve seat. Be sure to turn the cutter evenly downward at a pressure of 40–50 N (4–5 kgf, 8.8–11 lbf) to prevent chatter marks.

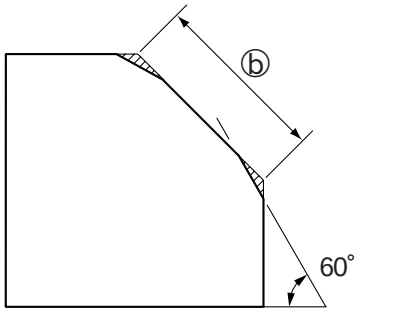
3. Use a 30° cutter to adjust the contact width of the top edge of the valve seat.



S6AG5J60J

ⓑ Previous contact width

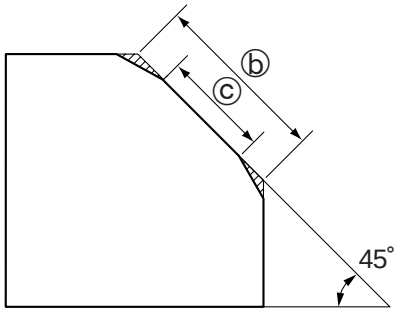
4. Use a 60° cutter to adjust the contact width of the bottom edge of the valve seat.



S6AG5J70J

ⓑ Previous contact width

5. Use a 45° cutter to adjust the contact width of the valve seat to specification.



S6AG5J80J

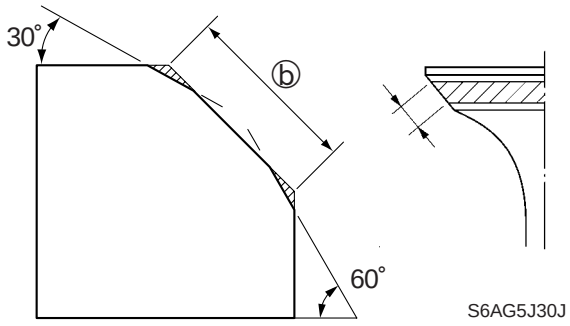
ⓑ Previous contact width
ⓒ Specified contact width

6. Check the valve seat contact area of the valve.

NOTE:

To check the valve seat contact area, see "Checking the valve seat" (5-31).

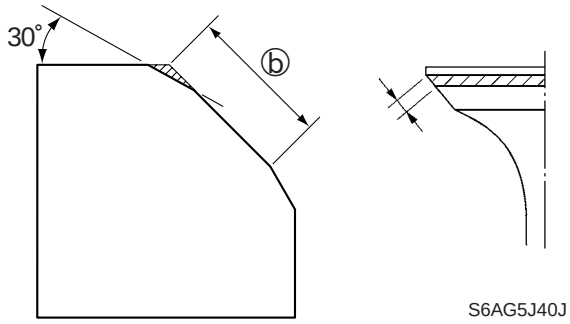
7. If the valve seat contact area is too wide and situated in the center of the valve face, use a 30° cutter to cut the top edge of the valve seat and a 60° cutter to cut the bottom edge to center the area and set its width.



S6AG5J30J

ⓑ Previous contact width

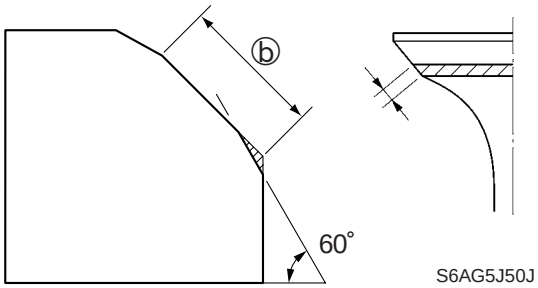
8. If the valve seat contact area is too narrow and situated near the top edge of the valve face, use a 30° cutter to cut the top edge of the valve seat, and then use a 45° cutter to center the area and set its width.



S6AG5J40J

ⓑ Previous contact width

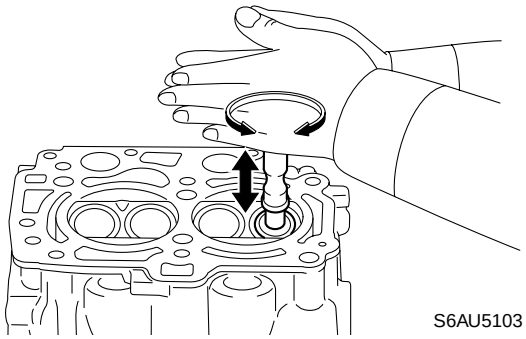
9. If the valve seat contact area is too narrow and situated near the bottom edge of the valve face, use a 60° cutter to cut the bottom edge of the valve seat, and then use a 45° cutter to center the area and set its width.



S6AG5J50J

ⓑ Previous contact width

10. After refacing the valve seat to the specified contact width, apply a thin, even layer of lapping compound onto the valve seat, and then lap the valve using a valve lapper.



S6AU5103

CAUTION:

Do not get the lapping compound on the valve stem and valve guide.

11. After every lapping procedure, be sure to clean off any remaining lapping compound from the cylinder head and the valve.

12. Check the valve seat contact area of the valve again.

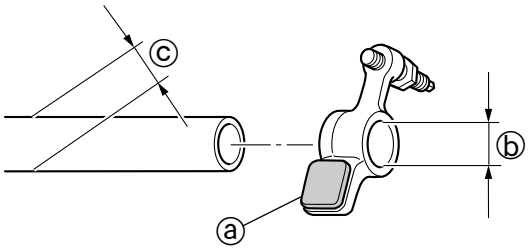
NOTE:

To check the valve seat contact area, see "Checking the valve seat" (5-31).

Checking the rocker arm and rocker arm shaft

1. Check the rocker arms, rocker arm shaft, and contact surface ⓐ of each rocker arm. Replace if worn.

2. Measure the rocker arm inside diameter ⓑ and rocker arm shaft outside diameter ⓒ. Replace if out of specification.



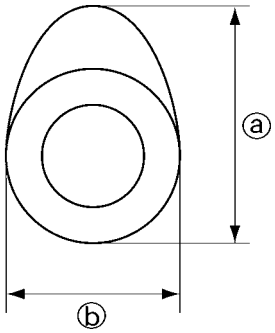
S6AU5104

Rocker arm inside diameter ⓑ:
13.000–13.018 mm
(0.5118–0.5125 in)
Rocker arm shaft outside diameter ⓒ:
12.941–12.951 mm
(0.5095–0.5099 in)

5

Checking the camshaft

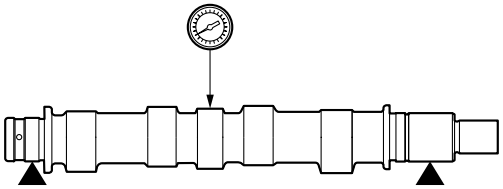
1. Measure the cam lobe. Replace if out of specification.



S69J5950

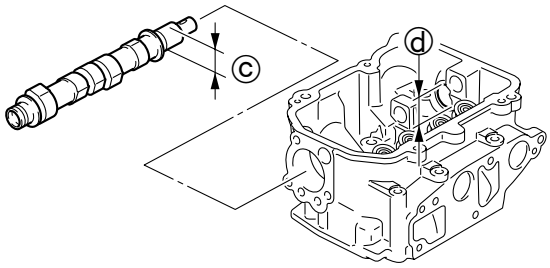
Cam lobe ⓐ:
Intake and exhaust:
23.45–23.55 mm
(0.9232–0.9272 in)
Cam lobe ⓑ:
Intake and exhaust:
19.95–20.05 mm
(0.7854–0.7894 in)

2. Measure the camshaft runout. Replace if above specification.


S6AU5106

Camshaft runout limit:
0.03 mm (0.0012 in)

3. Measure the camshaft journal diameter ⓒ and the cylinder head journal inside diameter ⓓ. Replace the camshaft, cylinder head, or both if out of specification.

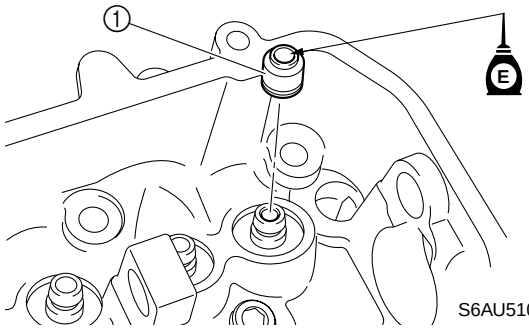


S6AU5107

Camshaft journal diameter ⓒ:
17.975–17.991 mm
(0.7077–0.7083 in)
Cylinder head journal inside diameter ⓓ:
18.000–18.018 mm
(0.7087–0.7094 in)

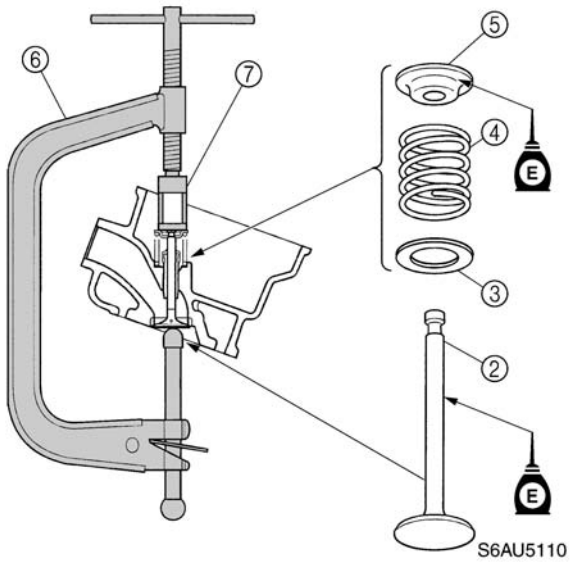
Assembling the cylinder head

1. Install a new valve seal ① onto the valve guide.



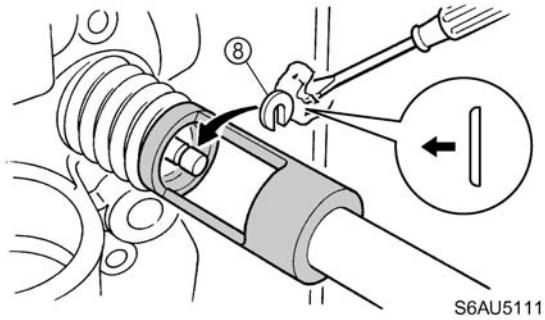
S6AU5109

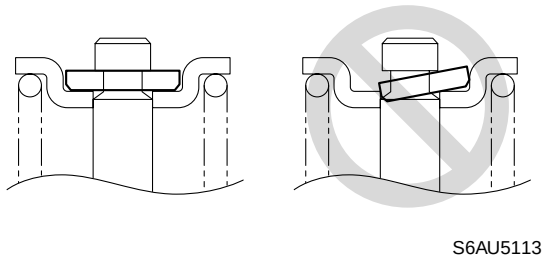
2. Install the valve ②, valve spring seat ③, valve spring ④, and valve spring retainer ⑤ in the sequence shown, and then attach the special service tools.



	Valve spring compressor ⑥: 90890-04019 Valve spring compressor attachment ⑦: 90890-06320

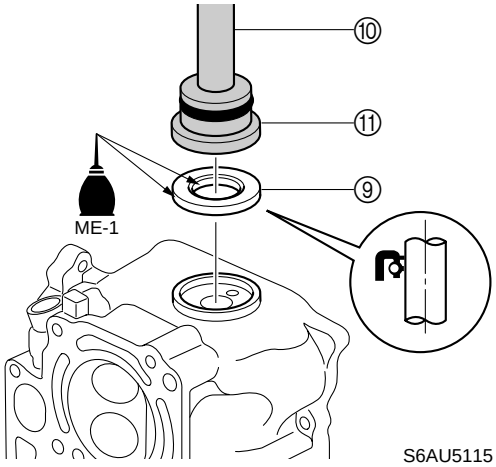
3. Compress the valve spring, and then install the valve cotter ⑧.





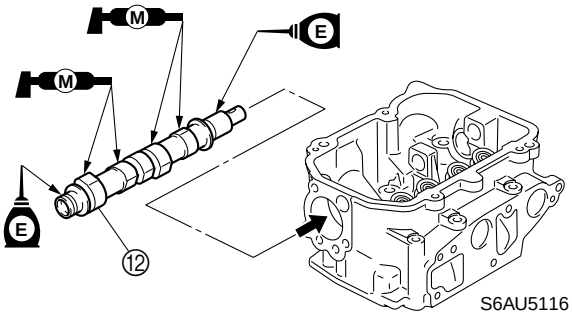
NOTE:
Make sure that the valve cotter ⑧ is fitted securely into the groove in the valve.

4. Install a new oil seal ⑨.

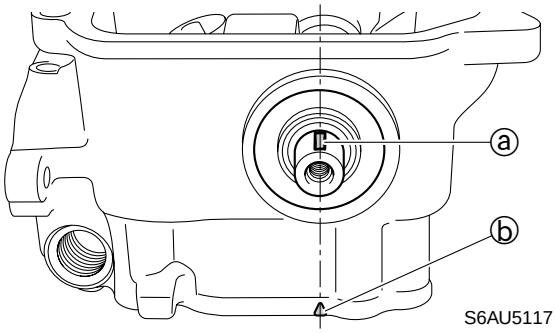


	Driver rod L3 ⑩: 90890-06652 Needle bearing attachment ⑪: 90890-06653

5. Install the camshaft ⑫ in the direction shown.



6. Align the keyway ⓐ in the camshaft with the "▲" mark ⓑ on the cylinder head as shown.



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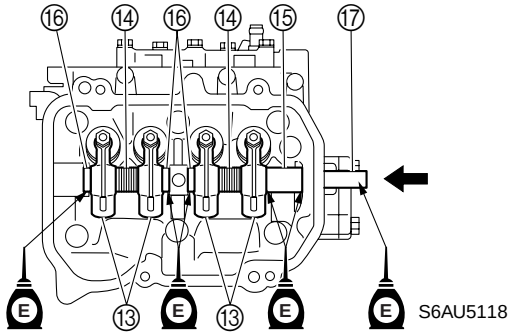
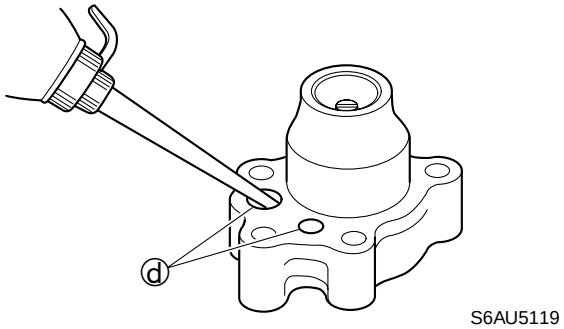
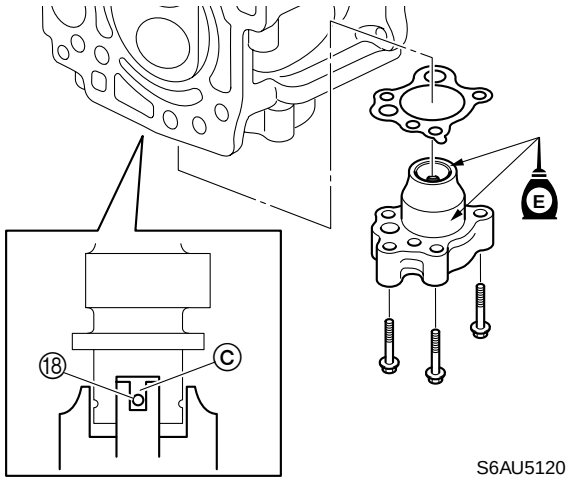
7. Install the rocker arms ⑬, springs ⑭, and collars ⑮ and ⑯ into the cylinder head, and then install the rocker arm shaft ⑰.



8. Install the oil pump assembly by aligning the slot ⓒ in the oil pump drive shaft with the camshaft pin ⑱.



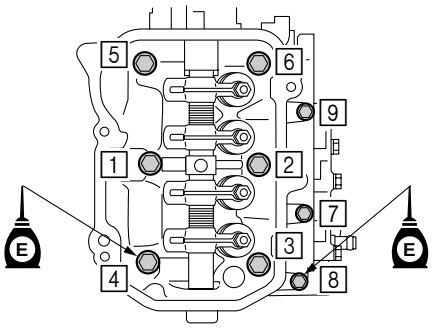


NOTE:
- To disassemble, check, and assemble the oil pump, see “Checking the oil pump” (5-37).
- Before installing the oil pump assembly, be sure to fill it with a small amount of engine oil through the oil passages ⓓ.

	Oil pump assembly bolt: 8 N·m (0.8 kgf·m, 5.9 ft·lb)

Installing the cylinder head

1. Install a new gasket, the dowels, and the cylinder head, and then tighten the bolts to the specified torques in the sequence shown.



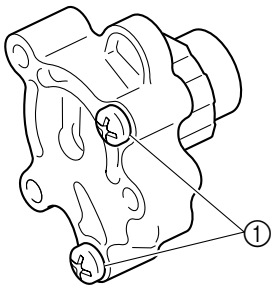
CAUTION:
Do not reuse the cylinder head gasket, always replace it with a new one.

NOTE:
- Apply engine oil to the cylinder head bolts before installation.
- Tighten the bolts to the specified torques in 2 stages.

	Cylinder head bolt (M8): 1st: 15 N·m (1.5 kgf·m, 11.1 ft·lb) 2nd: 29 N·m (2.9 kgf·m, 21.4 ft·lb) Cylinder head bolt (M6): 1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb) 2nd: 12 N·m (1.2 kgf·m, 8.9 ft·lb)

Checking the oil pump

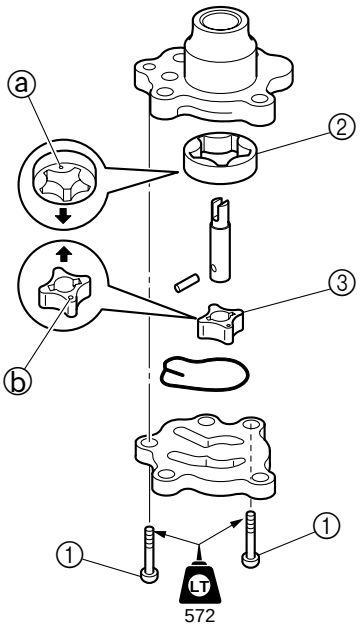
1. Remove the oil pump screws ① and disassemble the oil pump.



S6AU5122

2. Check the inner surface of the oil pump housing. Replace the oil pump assembly if scratched.

3. Assemble the oil pump, and then tighten the oil pump screws ① to the specified torque.

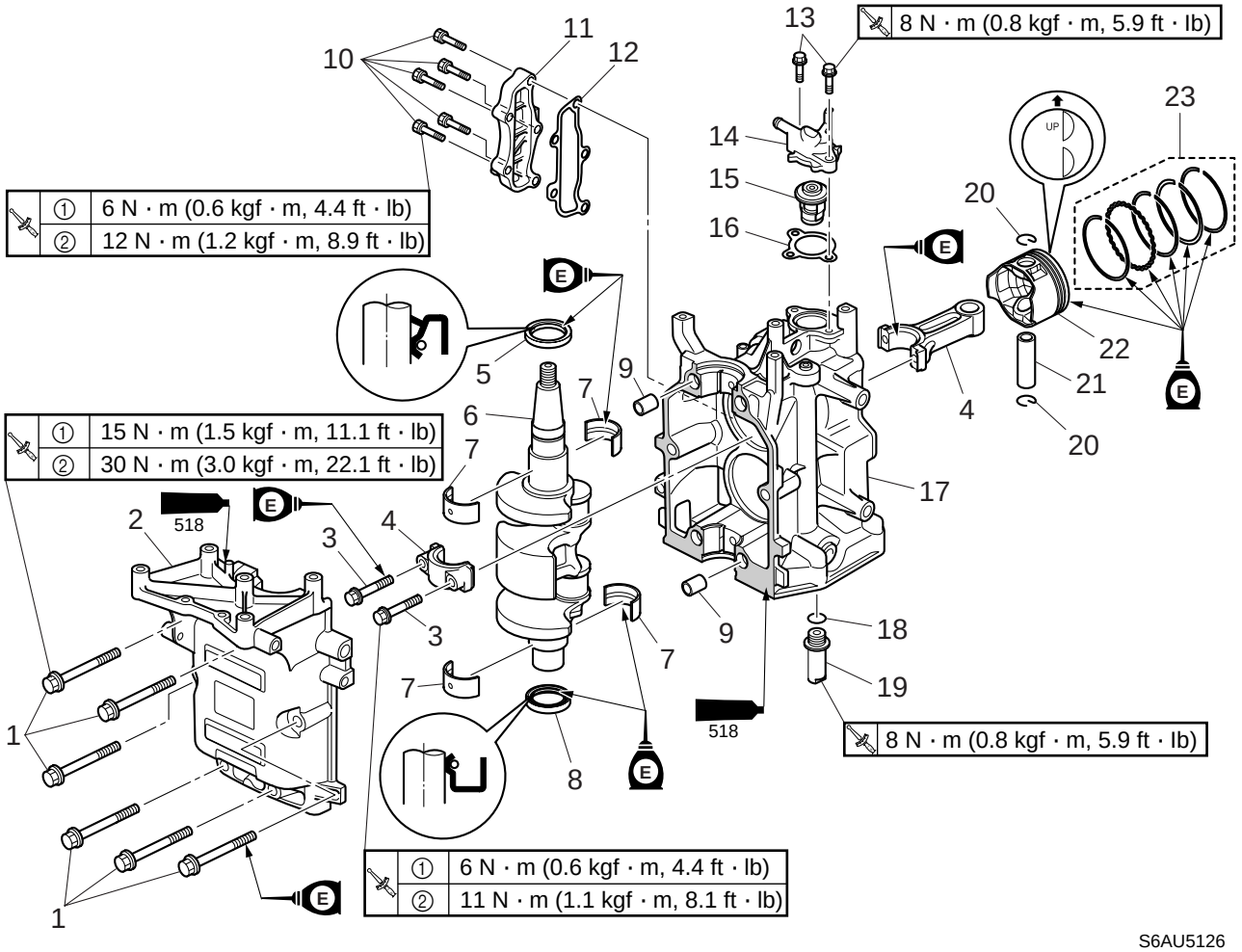


S6AU5125

NOTE:
- The punch mark ⓐ on the outer rotor ② faces towards the oil pump cover.
- The punch mark ⓑ on the inner rotor ③ faces towards the oil pump housing.

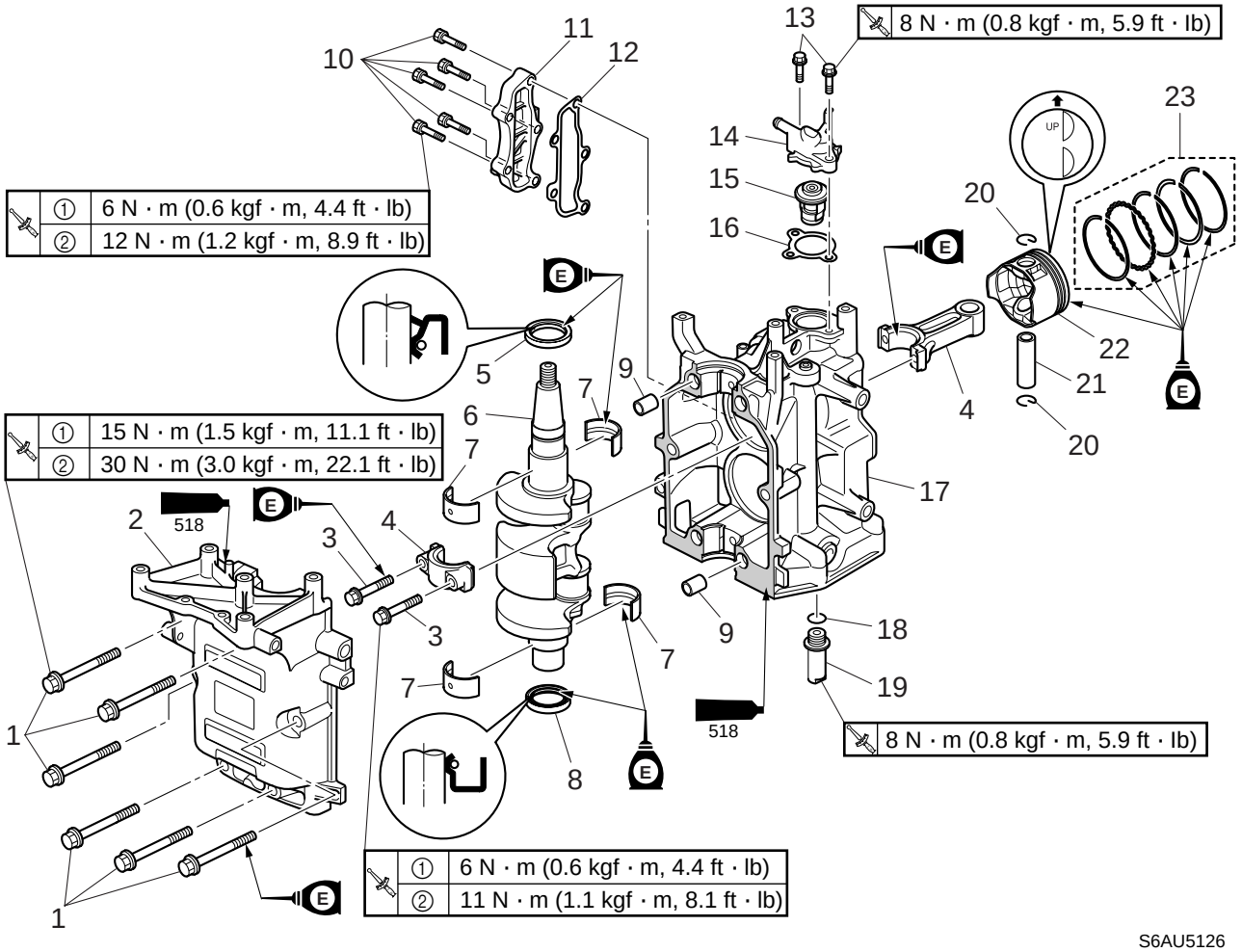
	Oil pump screw ①: 5 N·m (0.5 kgf·m, 3.7 ft·lb)

Cylinder block


8 N · m (0.8 kgf · m, 5.9 ft · lb)
① 6 N · m (0.6 kgf · m, 4.4 ft · lb)
② 12 N · m (1.2 kgf · m, 8.9 ft · lb)
① 15 N · m (1.5 kgf · m, 11.1 ft · lb)
② 30 N · m (3.0 kgf · m, 22.1 ft · lb)
① 6 N · m (0.6 kgf · m, 4.4 ft · lb)
② 11 N · m (1.1 kgf · m, 8.1 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
518
518
UP
E

S6AU5126

No.	Part name	Q'ty	Remarks
1	Bolt	6	M8 × 65 mm
2	Crankcase	1	
3	Bolt	4	M7 × 35 mm
4	Connecting rod	2	
5	Oil seal	1	**Not reusable**
6	Crankshaft	1	
7	Main bearing	4	
8	Oil seal	1	**Not reusable**
9	Dowel	2	
10	Bolt	5	M6 × 25 mm
11	Exhaust cover	1	
12	Gasket	1	**Not reusable**
13	Bolt	2	M6 × 20 mm
14	Thermostat cover	1	
15	Thermostat	1	
16	Gasket	1	**Not reusable**
17	Cylinder block	1	


8 N · m (0.8 kgf · m, 5.9 ft · lb)
① 6 N · m (0.6 kgf · m, 4.4 ft · lb)
② 12 N · m (1.2 kgf · m, 8.9 ft · lb)
① 15 N · m (1.5 kgf · m, 11.1 ft · lb)
② 30 N · m (3.0 kgf · m, 22.1 ft · lb)
① 6 N · m (0.6 kgf · m, 4.4 ft · lb)
② 11 N · m (1.1 kgf · m, 8.1 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
518
518
UP
E

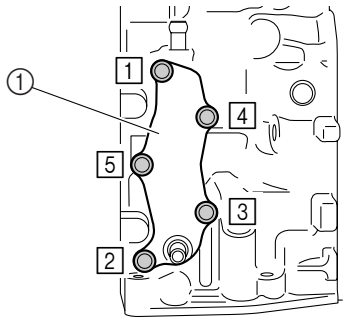
S6AU5126

No.	Part name	Q'ty	Remarks
18	O-ring	1	**Not reusable**
19	Relief valve	1	
20	Clip	4	**Not reusable**
21	Piston pin	2	
22	Piston	2	
23	Piston ring set	2	

5

Disassembling the cylinder block

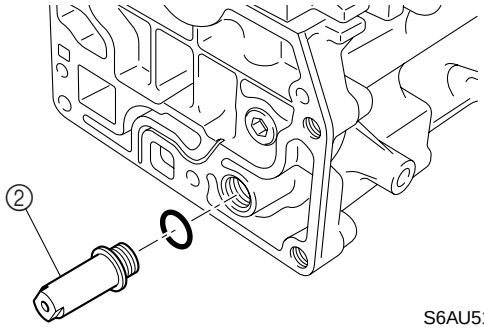
1. Remove the exhaust cover bolts in the sequence shown, and then remove the exhaust cover ①.



S6AU5127

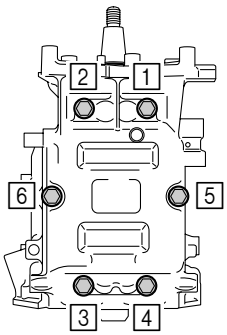
2. Remove the thermostat cover, thermostat, and gasket.

3. Remove the relief valve ②.



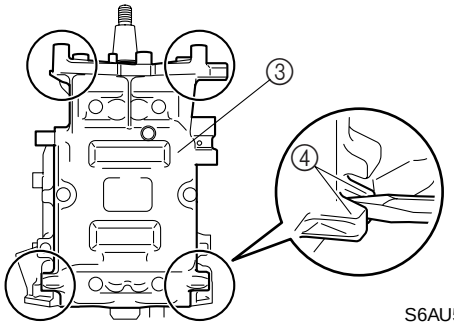
S6AU5128

4. Remove the crankcase bolts in the sequence shown.



S6AU5129

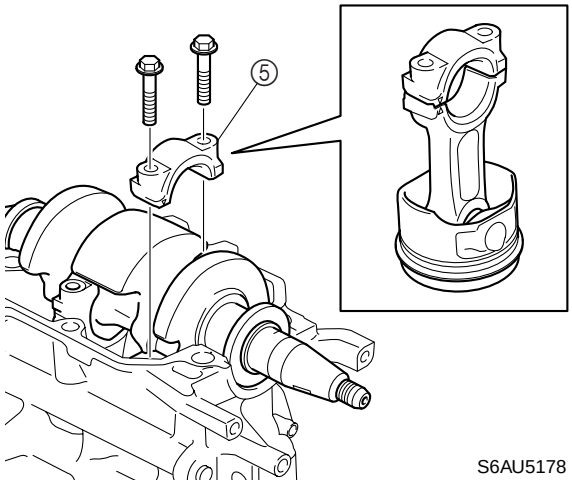
5. Remove the crankcase ③.



S6AU5177

NOTE:
Insert a flat-head screwdriver between the tabs ④ of the crankcase and the cylinder block to separate them.

6. Remove the connecting rod caps ⑤, and then remove the connecting rod and piston assemblies.

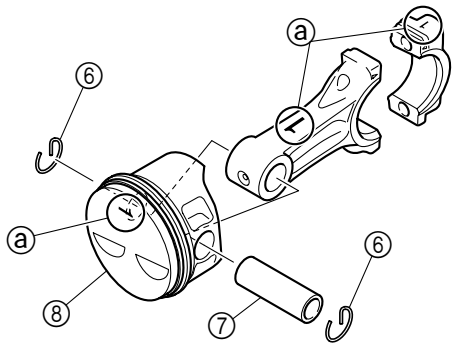


S6AU5178

7. Remove the crankshaft, main bearings and oil seals.

NOTE:
Be sure to keep the main bearings in the order as they were removed.

8. Remove the piston pin clips ⑥ and piston pin ⑦, and then remove the piston ⑧.



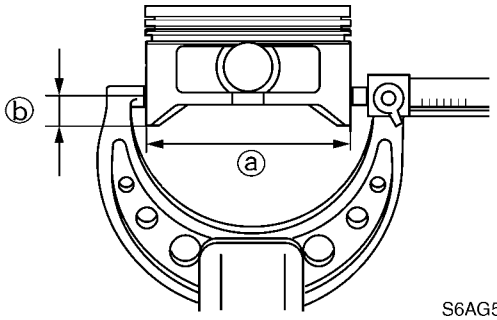
S6AU5130

NOTE:
To avoid interchanging the pistons, connecting rods, and connecting rod caps, mark each with an identification number ⓐ of the corresponding cylinder and be sure to keep them in the order as they were removed.

9. Remove the piston rings.

Checking the piston diameter

1. Measure the piston diameter at the specified measuring point. Replace if out of specification.

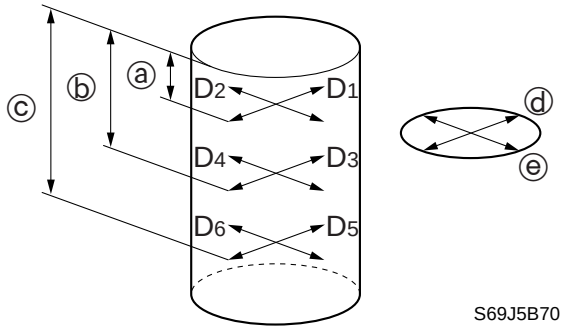


S6AG5850

Piston diameter ⓐ:
55.950–55.965 mm
(2.2028–2.2033 in)
Measuring point ⓑ:
1.5 mm (0.06 in) up from the bottom of the piston skirt
Oversize piston diameter:
Oversize 1st:
56.200–56.215 mm
(2.2126–2.2132 in)
Oversize 2nd:
56.450–56.465 mm
(2.2224–2.2230 in)

Checking the cylinder bore

1. Measure the cylinder bore (D_1–D_6) at measuring points ⓐ, ⓑ, and ⓒ, and in direction ⓓ (D_1, D_3, D_5), which is parallel to the crankshaft, and in direction ⓔ (D_2, D_4, D_6), which is at a right angle to the crankshaft.



S69J5B70

ⓐ 20 mm (0.8 in)
ⓑ 40 mm (1.6 in)
ⓒ 60 mm (2.4 in)

Cylinder bore (D_1–D_6):
56.000–56.015 mm
(2.2047–2.2053 in)

Checking the piston clearance

1. Check the piston clearances if replacing the piston, piston ring set, cylinder block, or all parts.

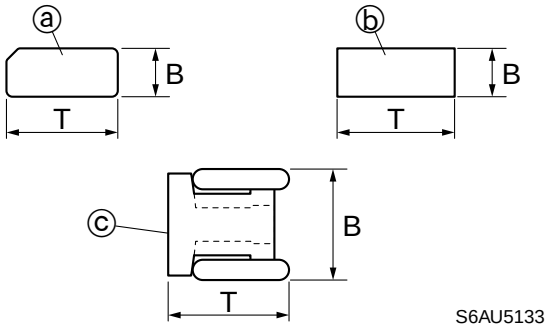
NOTE:
The figures are for reference only. Depending on how the parts are assembled, the actual measurements may not be within the specified ranges.

Piston clearance (reference data):
0.035–0.065 mm
(0.0014–0.0026 in)

5

Checking the piston ring

1. Measure the piston ring dimensions B and T. Replace the piston ring set if out of specification.

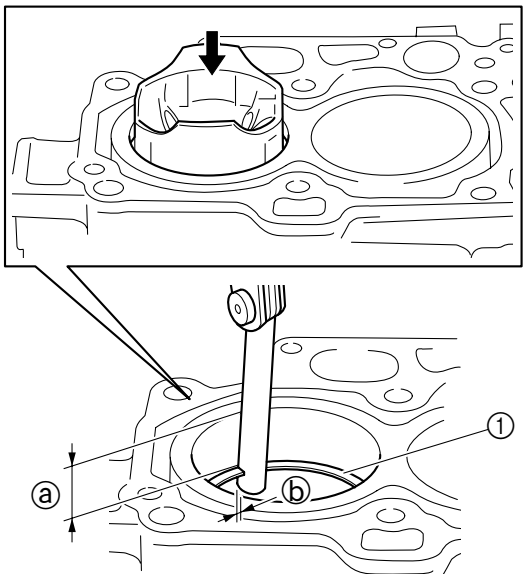


S6AU5133

Piston ring dimensions:
- Top ring ⓐ:
  - B: 1.17–1.19 mm (0.0461–0.0469 in)
  - T: 1.95–2.15 mm (0.0768–0.0846 in)
- 2nd ring ⓑ:
  - B: 1.47–1.49 mm (0.0579–0.0587 in)
  - T: 2.40–2.60 mm (0.0945–0.1024 in)
- Oil ring ⓒ:
  - B: 2.35–2.50 mm (0.0925–0.0984 in)
  - T: 2.30–2.60 mm (0.0906–0.1024 in)

Checking the piston ring end gap

1. Level the piston ring ① in the cylinder with a piston crown at the specified measuring point ⓐ.
2. Measure the piston ring end gap ⓑ.



S6AU5134

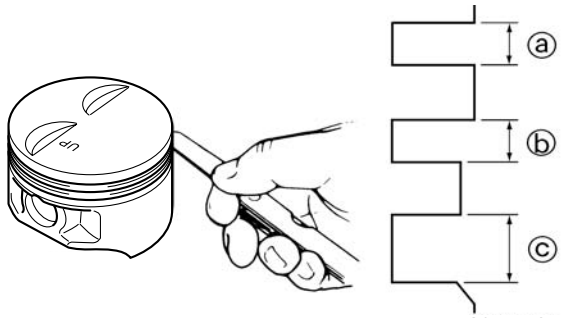
NOTE:
The figures are for reference only. Depending on how the parts are assembled, the actual measurements may not be within the specified ranges.

Piston ring end gap ⓑ (reference data):
- Top ring:
  - 0.15–0.30 mm (0.0059–0.0118 in)
- 2nd ring:
  - 0.30–0.45 mm (0.0118–0.0177 in)
- Oil ring:
  - 0.20–0.70 mm (0.0079–0.0276 in)

Measuring point ⓐ (reference data):
- 10 mm (0.4 in)

Checking the piston ring groove

1. Measure the piston ring grooves. Replace the piston if out of specification.

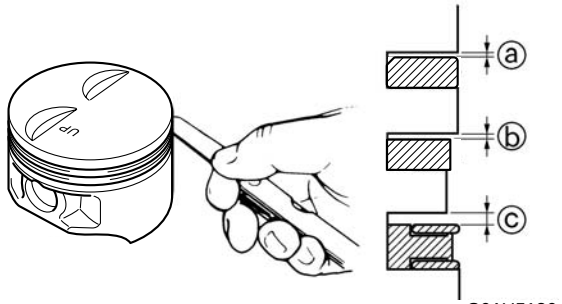


S6AU5135

Piston ring groove:
Top ring ⓐ:
1.23–1.25 mm
(0.0484–0.0492 in)
2nd ring ⓑ:
1.52–1.54 mm
(0.0598–0.0606 in)
Oil ring ⓒ:
2.51–2.53 mm
(0.0988–0.0996 in)

Checking the piston ring side clearance

1. Measure the piston ring side clearance. Replace the piston and piston rings as a set if out of specification.

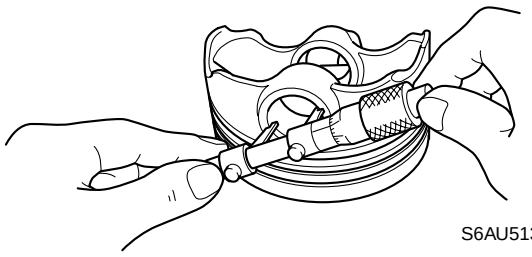


S6AU5136

Piston ring side clearance:
Top ring ⓐ:
0.04–0.08 mm
(0.0016–0.0031 in)
2nd ring ⓑ:
0.03–0.07 mm
(0.0012–0.0028 in)
Oil ring ⓒ:
0.01–0.18 mm
(0.0004–0.0071 in)

Checking the piston pin boss bore

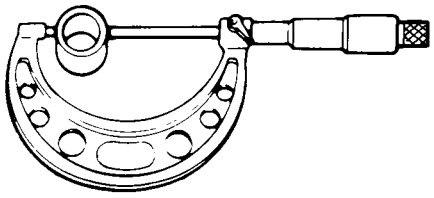
1. Measure the piston pin boss bore. Replace the piston if out of specification.


S6AU5137

Piston pin boss bore:
14.004–14.015 mm
(0.5513–0.5518 in)

Checking the piston pin diameter

1. Measure the piston pin diameter. Replace if out of specification.


S69J5C30

Piston pin diameter:
13.996–14.000 mm
(0.5510–0.5512 in)

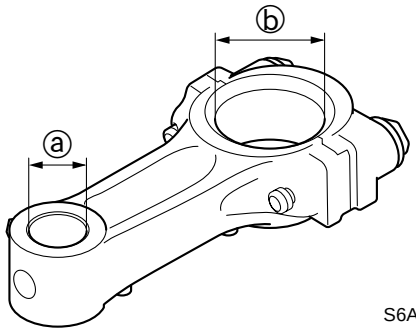
Checking the connecting rod small end inside diameter and big end inside diameter

1. Tighten the connecting rod cap bolts to the specified torques in 2 stages.

Connecting rod cap bolt:
1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb)
2nd: 11 N·m (1.1 kgf·m, 8.1 ft·lb)

5

2. Measure the connecting rod small end inside diameter ⓐ and big end inside diameter ⓑ. Replace the connecting rod if out of specification.

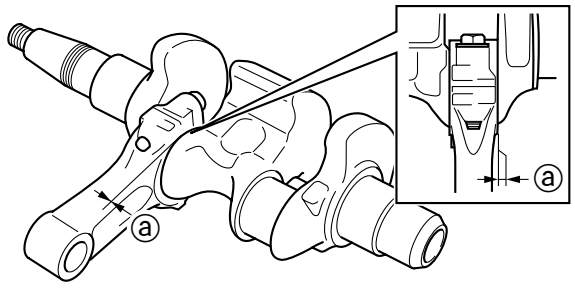


S6AU5139

Connecting rod small end inside diameter ⓐ:
14.015–14.029 mm
(0.5518–0.5523 in)
Connecting rod big end inside diameter ⓑ:
27.030–27.042 mm
(1.0642–1.0646 in)

Checking the connecting rod big end side clearance

1. Measure the connecting rod big end side clearance ⓐ.

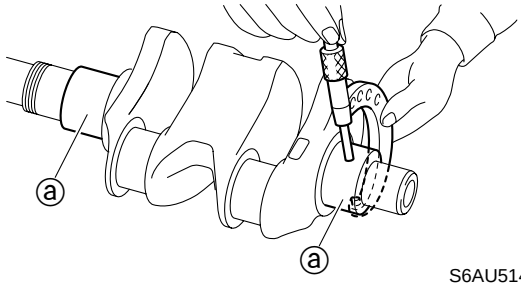


S6AU5140

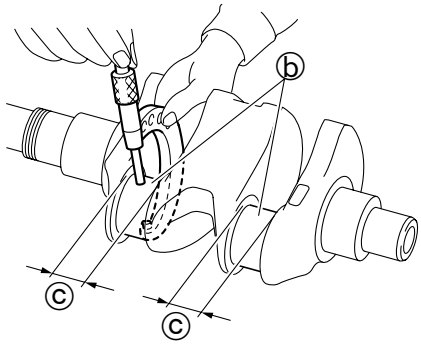
Connecting rod big end side clearance ⓐ (reference data):
0.05–0.22 mm (0.0020–0.0087 in)

Checking the crankshaft

1. Measure the crankshaft journal diameters ⓐ, crankpin diameters ⓑ, and crankpin widths ⓒ. Replace the crankshaft if out of specification.



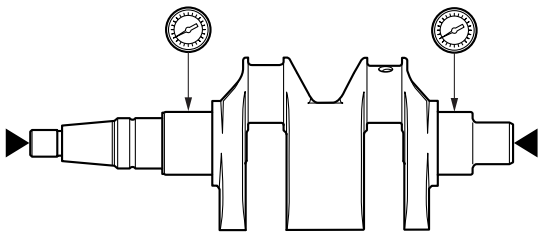
S6AU5141



S6AU5142

Crankshaft journal diameter ⓐ:
30.002–30.014 mm
(1.0582–1.0586 in)
Crankpin diameter ⓑ:
26.997–27.009 mm
(1.0629–1.0633 in)
Crankpin width ⓒ:
21.000–21.070 mm
(0.8268–0.8295 in)

2. Measure the crankshaft runout. Replace if above specification.

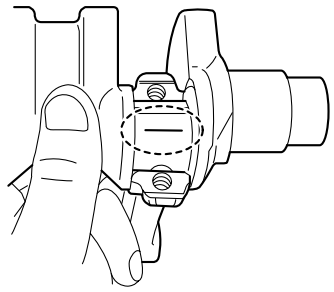

S6AU5143

Crankshaft runout limit:
0.05 mm (0.0020 in)

Checking the crankpin oil clearance

1. Clean the contact surfaces of the connecting rod and crankpin.

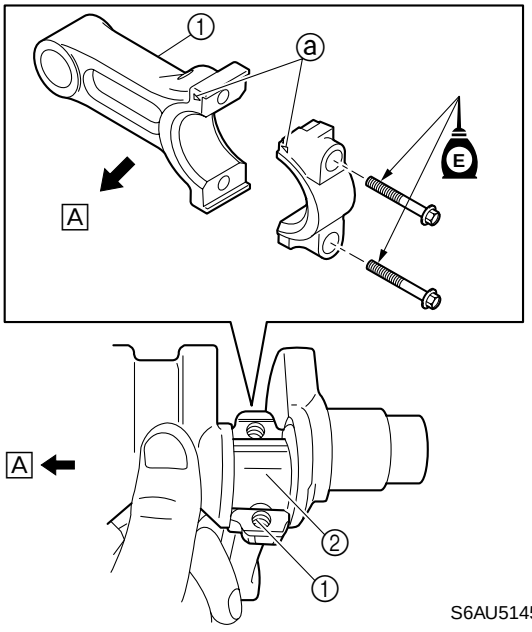
2. Put a piece of Plastigauge (PG-1) onto the crankpin, parallel to the crankshaft.



S6AU5144

NOTE:
Be sure not to put the Plastigauge (PG-1) over the oil hole in the crankpin of the crankshaft.

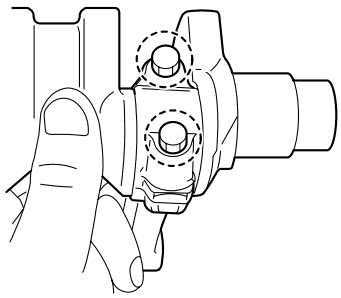
3. Install the connecting rod ① to the crankpin ②.



S6AU5145

NOTE:
Make sure that the "▲" marks ⓐ of the connecting rod face towards the flywheel magnet end A of the crankshaft.

4. Tighten the connecting rod cap bolts to the specified torques in 2 stages.

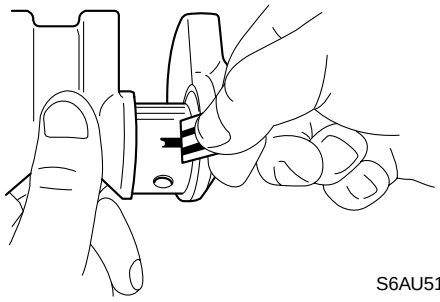


S6AU5146

NOTE:
Do not turn the connecting rod until the crankpin oil clearance measurement has been completed.

Connecting rod cap bolt:
1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb)
2nd: 11 N·m (1.1 kgf·m, 8.1 ft·lb)

5. Remove the connecting rod cap and measure the width of the compressed Plastigauge (PG-1) on the crankpin. Check the connecting rods and crankshaft if out of specification and replace the defective parts.



S6AU5147

Crankpin oil clearance (reference data):
0.021–0.045 mm
(0.0008–0.0018 in)

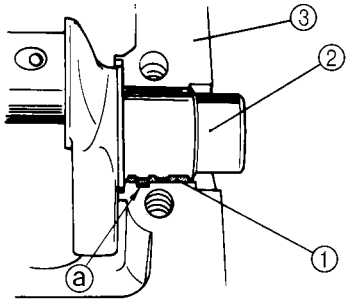
Checking the crankshaft journal oil clearance

1. Clean the main bearings, crankshaft journals, and bearing portions of the crankcase and cylinder block.

5

2. Place the cylinder block upside down on a bench.

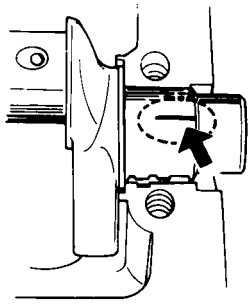
3. Install half of the main bearings ① and the crankshaft ② into the cylinder block ③.



S6D55860

NOTE:
- Install the main bearings in their original positions.
- Insert the projection ⓐ of each bearing into the slots in the cylinder block.

4. Put a piece of Plastigauge (PG-1) on each crankshaft journal parallel to the crankshaft.


S6D55870

NOTE:
Be sure not to put the Plastigauge (PG-1) over the oil hole in each crankshaft journal.

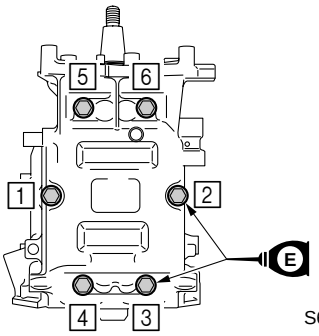
5. Install the remaining half of the main bearings into the crankcase.

NOTE:
- Install the main bearings in their original positions.
- Insert the projection of each bearing into the slots in the crankcase.

6. Install the crankcase onto the cylinder block.

NOTE:
Apply engine oil to the threads of the crankcase bolts.

7. Tighten the crankcase bolts to the specified torques in 2 stages and in the sequence shown.

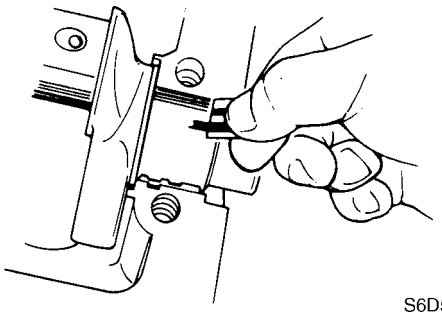


S6AU5150

NOTE:
Do not turn the crankshaft until the crankshaft journal oil clearance measurement has been completed.

Crankcase bolt:
1st: 15 N·m (1.5 kgf·m, 11.1 ft·lb)
2nd: 30 N·m (3.0 kgf·m, 22.1 ft·lb)

8. Gently remove the crankcase, and then measure the width of the compressed Plastigauge (PG-1) on each crankshaft journal. Replace the main bearings if out of specification.

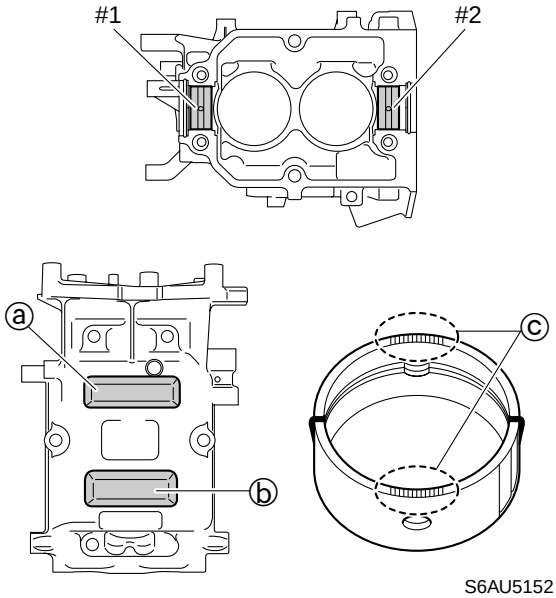

S6D55880

NOTE:
When loosening the crankcase bolts, loosen them in the opposite order used for tightening.

Crankshaft journal oil clearance (reference data):
0.006–0.034 mm
(0.0002–0.0013 in)

Selecting the crankshaft main bearing

1. Check the stamped marks ⓐ and ⓑ on the crankcase.



S6AU5152

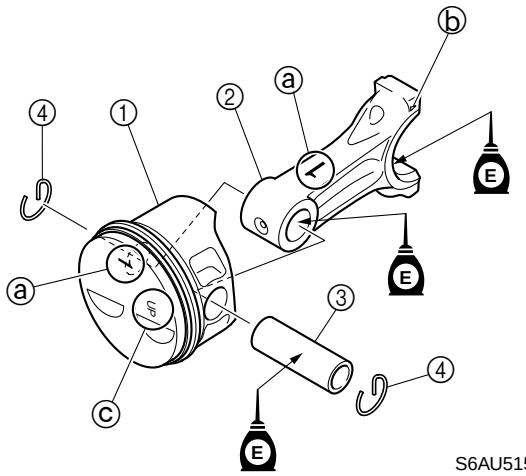
NOTE:
The stamped mark ⓐ is for the main bearings of crankshaft journal #1 and the stamped mark ⓑ is for the main bearings of crankshaft journal #2.

2. Select the suitable bearing color ⓒ for the main bearings from the table.

Stamped marks ⓐ and ⓑ	Bearing color ⓒ
A	Blue
B	Black
C	Brown

Assembling the cylinder block

1. Assemble the piston ①, connecting rod ②, piston pin ③, and piston pin clips ④.



S6AU5153

CAUTION:
Do not reuse the piston pin clips ④, always replace them with new ones.

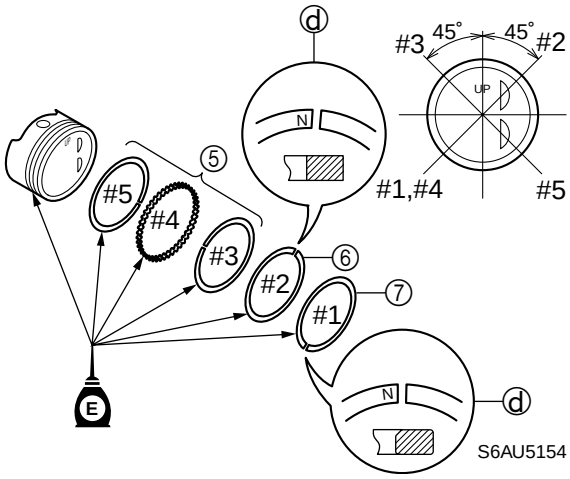
NOTE:
- Before assembly, make sure that the identification numbers ⓐ made on the piston and connecting rod during removal are the same.
- Face the "▲" mark ⓑ on the connecting rod in the same direction as the "UP" mark ⓒ on the piston.

5

2. Install the oil ring ⑤, 2nd ring ⑥, and top ring ⑦ onto each piston.

NOTE:
Make sure that the "N" marks ⓓ of the 2nd ring and the top ring are facing upward.

3. Offset the piston ring end gaps as shown.

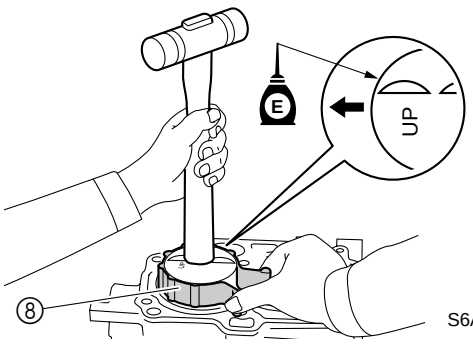


S6AU5154

CAUTION:
Do not scratch the pistons or break the piston rings.

NOTE:
After installing the piston rings, check that they move smoothly.

4. Install the piston with the "UP" mark on the piston crown facing towards the fly-wheel magnet.

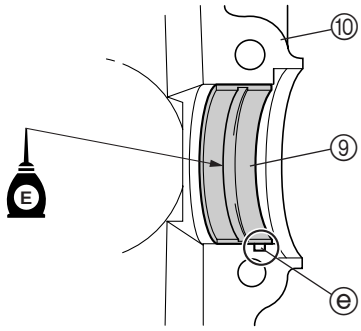


S6AU5156

NOTE:
Apply engine oil to the side of each piston and the piston rings before installation.

Piston slider ⑧: 90890-06843

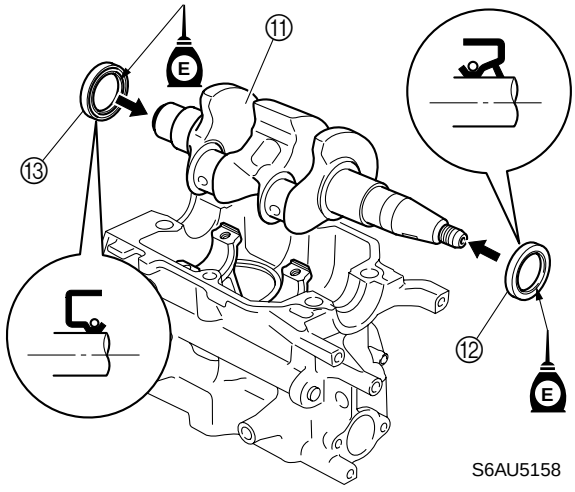
5. Install half of the main bearings ⑨ into the cylinder block ⑩.



S6AU5157

NOTE:
- Install the main bearings in their original positions.
- Insert the projection ⓔ of each bearing into the slots in the cylinder block.

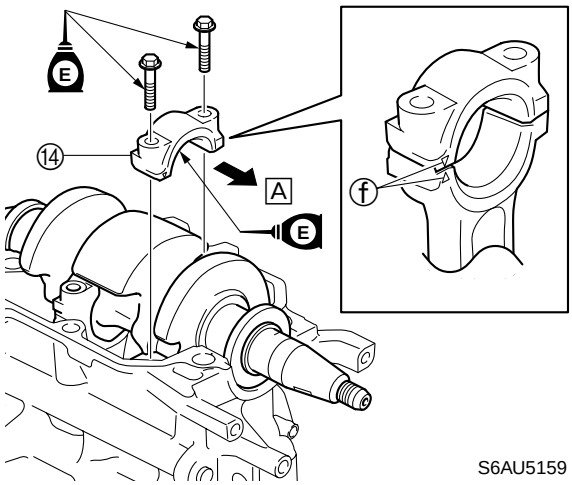
6. Install the crankshaft ⑪ and oil seals ⑫ and ⑬ into the cylinder block as shown.



S6AU5158

NOTE:
Apply engine oil to the inside of each oil seal before installation.

7. Install the connecting rod caps ⑭ to the connecting rods, and then tighten the connecting rod cap bolts to the specified torques in 2 stages.



S6AU5159

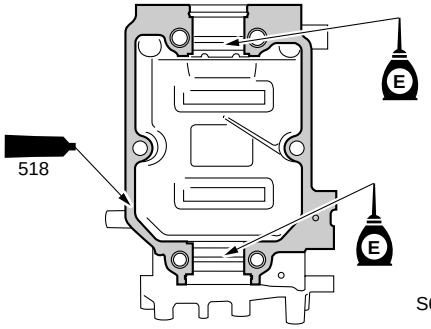
NOTE:
- Make sure that the "▲" marks ⓕ on the connecting rod cap face towards the flywheel magnet end A of the crankshaft.
- Apply engine oil to the connecting rod cap bolts before installation.
- After tightening the connecting rod cap bolts, check that the crankshaft rotates smoothly.

Connecting rod cap bolt:
1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb)
2nd: 11 N·m (1.1 kgf·m, 8.1 ft·lb)

8. Install the remaining half of the main bearings into the crankcase.

NOTE:
- Install the main bearings in their original positions.
- Insert the projection of each bearing into the slots in the crankcase.

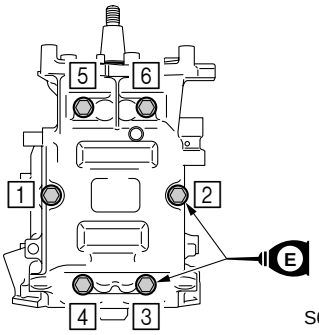
9. Apply sealant to the mating surface of the crankcase.



S6AU5160

NOTE:
Do not get any sealant on the main bearings.

10. Install the crankcase onto the cylinder block, and then tighten the crankcase bolts to the specified torques in 2 stages and in the sequence shown.



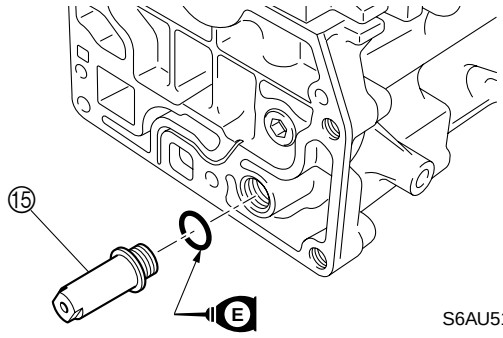
S6AU5150

NOTE:
Apply engine oil to the threads of the crankcase bolts before installation.

Crankcase bolt:
1st: 15 N·m (1.5 kgf·m, 11.1 ft·lb)
2nd: 30 N·m (3.0 kgf·m, 22.1 ft·lb)

5

11. Install the relief valve ⑮ and tighten it to the specified torque.



S6AU5162

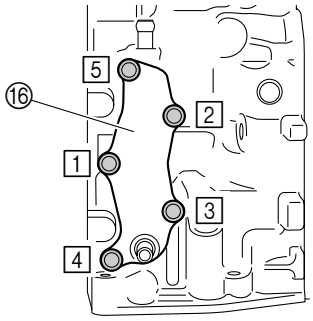
NOTE:
Apply a thin coat of engine oil to the O-ring of the relief valve ⑮ before installation.

Relief valve ⑮:
8 N·m (0.8 kgf·m, 5.9 ft·lb)

12. Install a new gasket, the thermostat, and the thermostat cover.

Thermostat cover bolt:
8 N·m (0.8 kgf·m, 5.9 ft·lb)

13. Install a new gasket and the exhaust cover ⑯, and then tighten the bolts to the specified torques in 2 stages and in the sequence shown.



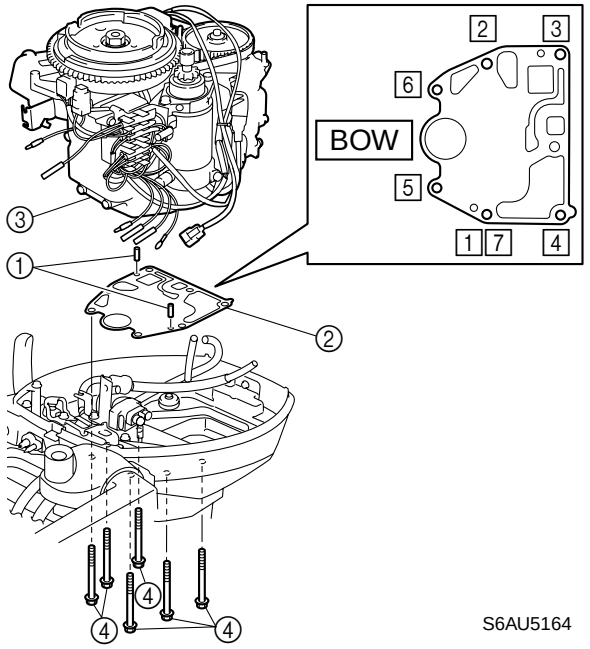
S6AU5163

Exhaust cover bolt:
1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb)
2nd: 12 N·m (1.2 kgf·m, 8.9 ft·lb)

Installing the power unit

1. Clean the power unit mating surface.
2. Install the dowels ①, a new gasket ②, and the power unit ③, and then tighten the mounting bolts ④ to the specified torque.

CAUTION:
Do not reuse the gasket, always replace it with a new one.



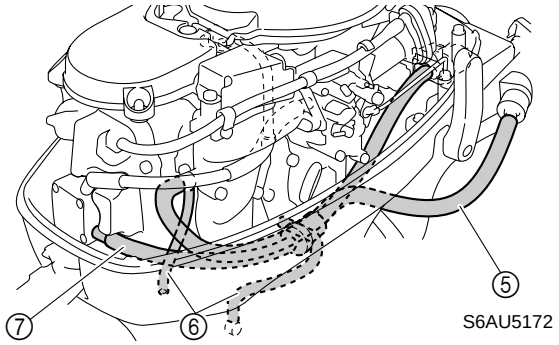
S6AU5164

Power unit mounting bolt ④:
21 N·m (2.1 kgf·m, 15.5 ft·lb)

3. Install the apron, dipstick, and choke rod.
4. Connect the throttle cables onto the throttle cam, and then adjust the cables. (H model)
   Connect the throttle cable joint onto the throttle cam, and then adjust the throttle cable. (R model)

NOTE:
To adjust the throttle cable(s), see “Adjusting the throttle cable (H model)” (3-7) or “Adjusting the throttle cable (R model)” (3-8).

5. Connect the flushing hose ⑤ (for Europe), cooling water hoses ⑥, and fuel hose ⑦.



6. Connect the engine shut-off switch leads, oil pressure warning indicator leads, and engine start button leads. (H model)
   Connect the 10-pin main harness to the power unit. (R model)

NOTE:
To connect the leads, see “Electrical component and wiring harness routing” (8-1).

7. Install the PT relay and connect the PT relay lead, PT switch coupler, and PT switch lead. (PT model)

8. Connect the battery cables, battery lead, and starter motor lead. (E model)

9. Install the manual starter and driven sprocket cover, and then connect the start-in-gear protection cable. (M model)
   Install the flywheel magnet cover and driven sprocket cover. (E model)

NOTE:
To connect the start-in-gear protection cable, see “Checking the start-in-gear protection (M model)” (3-11).

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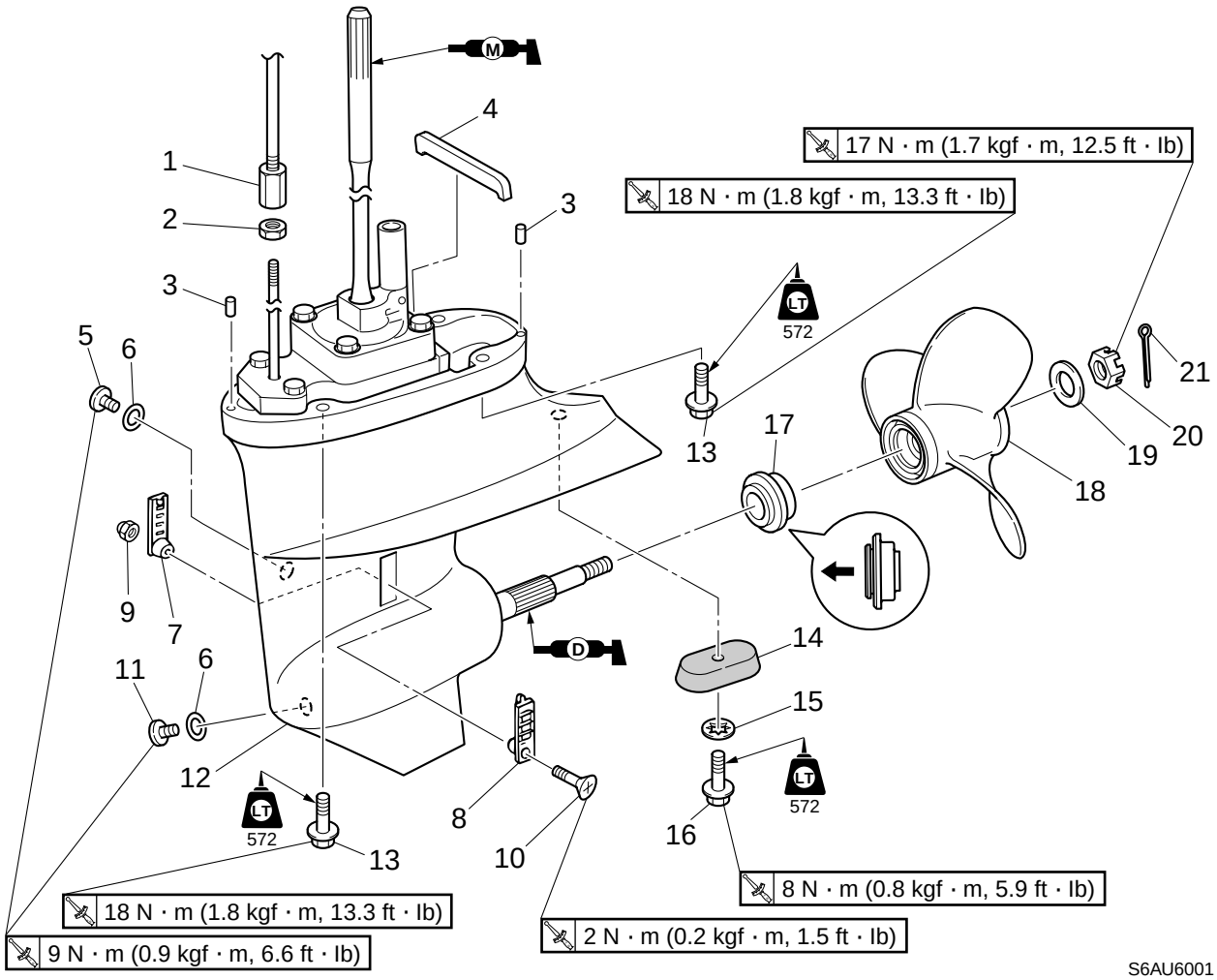
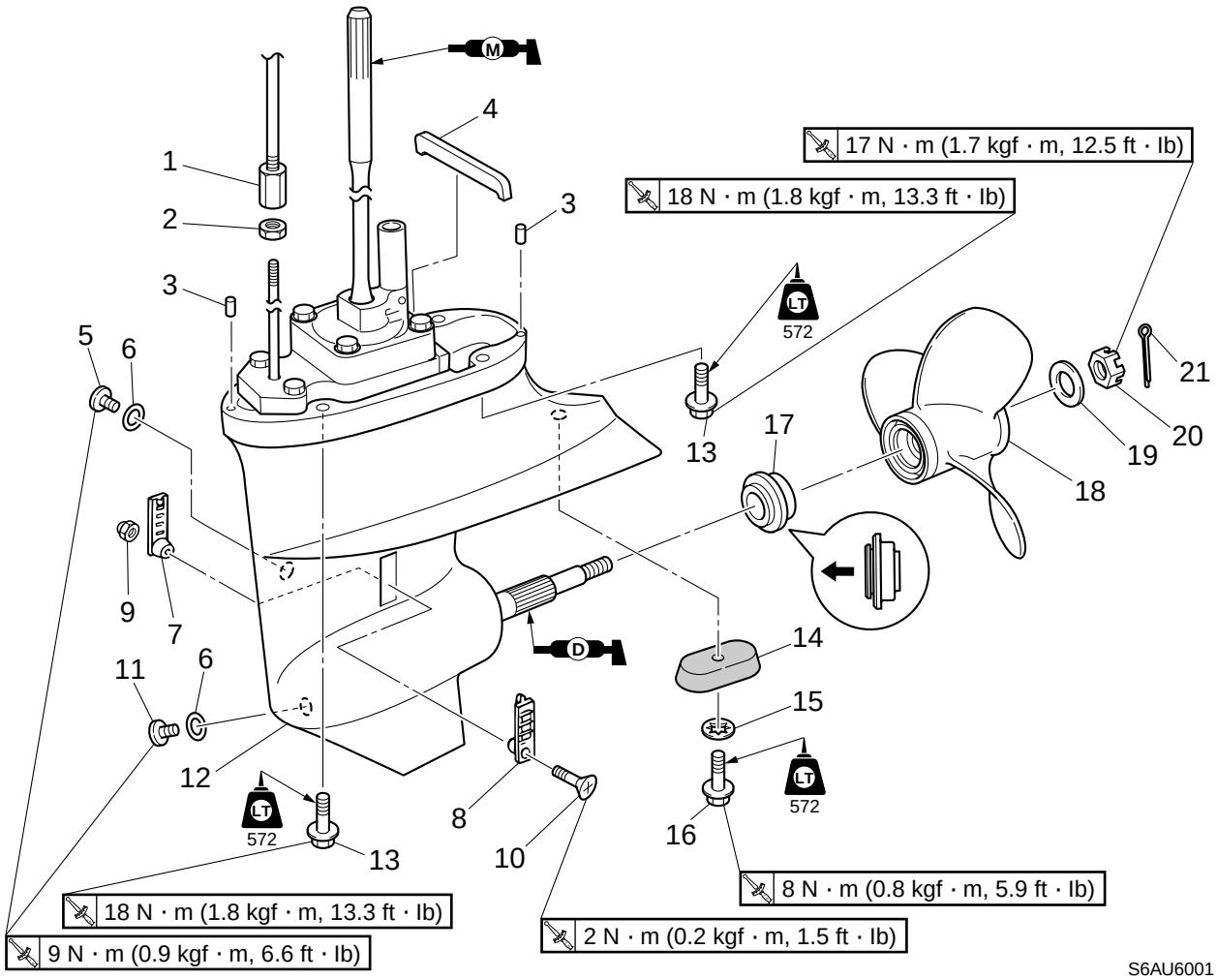
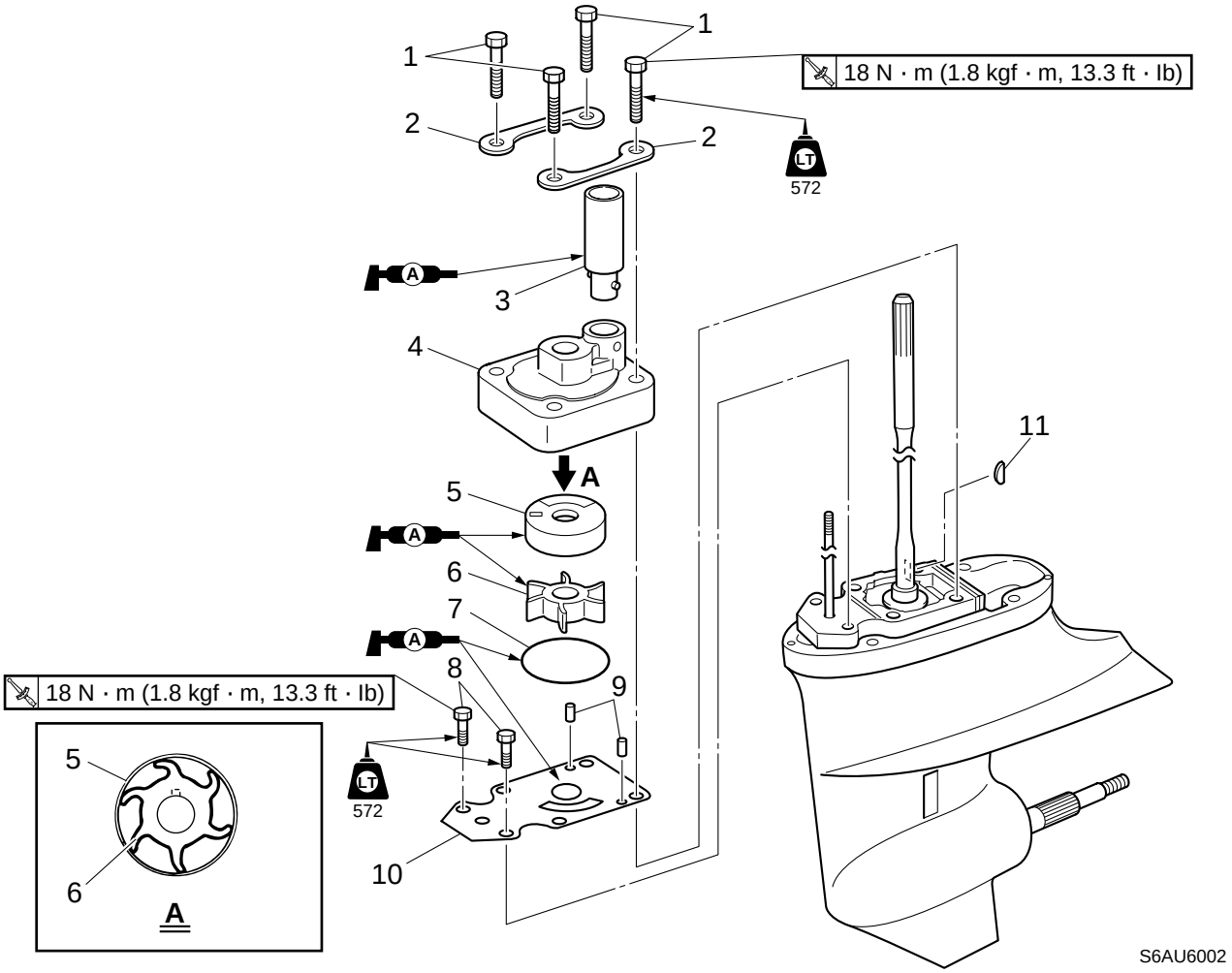
Lower unit


17 N · m (1.7 kgf · m, 12.5 ft · lb)
18 N · m (1.8 kgf · m, 13.3 ft · lb)
572
572
572
18 N · m (1.8 kgf · m, 13.3 ft · lb)
9 N · m (0.9 kgf · m, 6.6 ft · lb)
2 N · m (0.2 kgf · m, 1.5 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
S6AU6001

No.	Part name	Q'ty	Remarks
1	Adjusting nut	1	
2	Locknut	1	
3	Dowel	2	
4	Rubber seal	1	
5	Check screw	1	
6	Gasket	2	**Not reusable**
7	Cooling water inlet cover	1	Short
8	Cooling water inlet cover	1	Long
9	Nut	1	
10	Screw	1	ø5 × 16 mm
11	Drain screw	1	
12	Lower case	1	
13	Bolt	4	M8 × 35 mm
14	Anode	1	
15	Special washer	1	**Not reusable**
16	Bolt	1	M6 × 16 mm
17	Spacer	1	


17 N · m (1.7 kgf · m, 12.5 ft · lb)
18 N · m (1.8 kgf · m, 13.3 ft · lb)
572
572
572
18 N · m (1.8 kgf · m, 13.3 ft · lb)
9 N · m (0.9 kgf · m, 6.6 ft · lb)
2 N · m (0.2 kgf · m, 1.5 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
S6AU6001

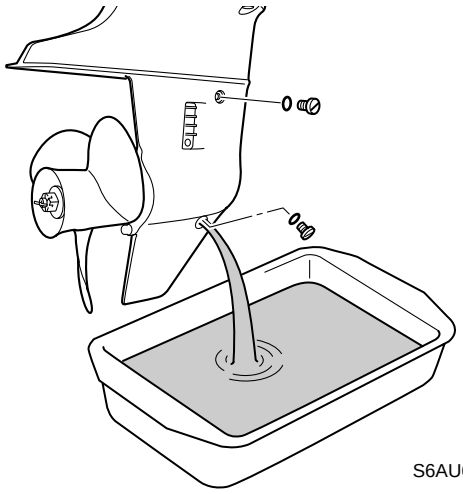
No.	Part name	Q'ty	Remarks
18	Propeller	1	
19	Washer	1	
20	Propeller nut	1	
21	Cotter pin	1	**Not reusable**



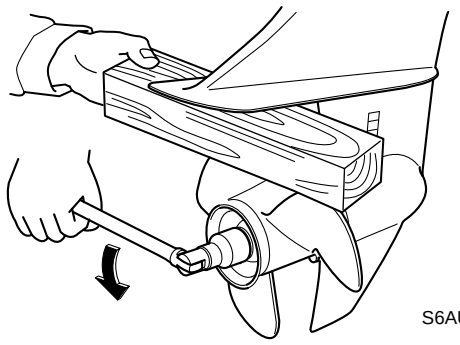
No.	Part name	Q'ty	Remarks
1	Bolt	4	M8 × 45 mm
2	Plate	2	
3	Rubber seal	1	
4	Water pump housing	1	
5	Insert cartridge	1	
6	Impeller	1	
7	O-ring	1	**Not reusable**
8	Bolt	2	M8 × 25 mm
9	Dowel	2	
10	Outer plate cartridge	1	
11	Woodruff key	1	

Removing the lower unit

1. Drain the gear oil.


S6AU6003

2. Set the gear shift to the N position, place a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning, and then remove the propeller nut and propeller.


S6AU6004

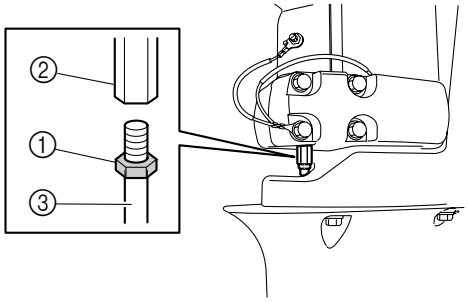
⚠ WARNING

- **Do not hold the propeller with your hands when loosening or tightening it.**
- **Be sure to disconnect the battery cables from the battery and remove the clip from the engine shut-off switch. (E model)**

3. Loosen the locknut ① while holding the adjusting nut ②, and then turn the adjusting nut to disconnect the shift rod ③.

NOTE:
Set the gear shift to the R position before disconnecting the shift rod.

4. Remove the locknut ①.

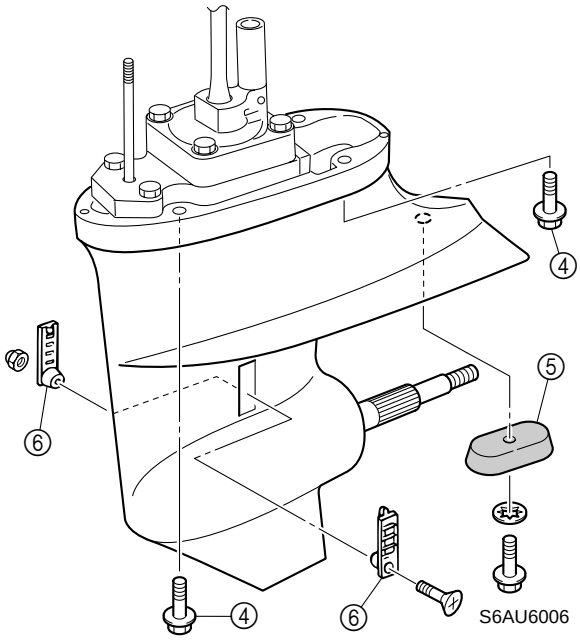


S6AU6005

NOTE:
Be sure to remove the locknut from the shift rod before removing the lower unit.

5. Remove the lower unit by removing the lower case mounting bolts ④.

6. Remove the anode ⑤ and cooling water inlet covers ⑥.



S6AU6006

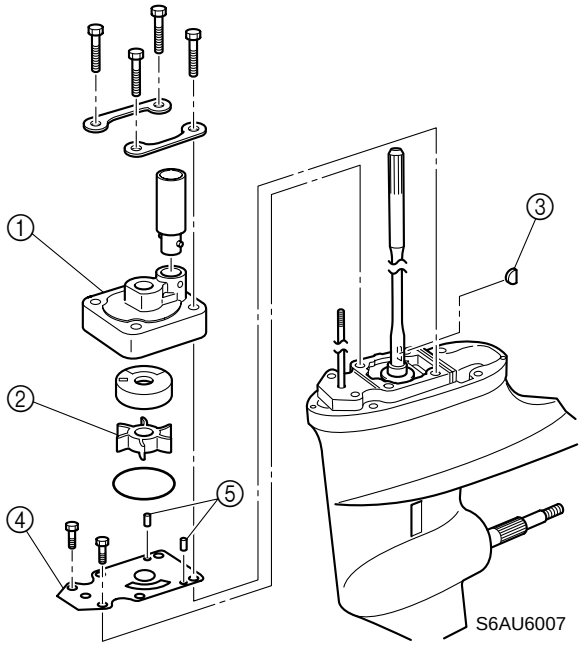
6

Removing the water pump

1. Remove the water pump housing ① and impeller ②.

2. Remove the Woodruff key ③ from the drive shaft, and then remove the outer plate cartridge ④.

3. Remove the dowels ⑤ from the lower case.



Checking the water pump

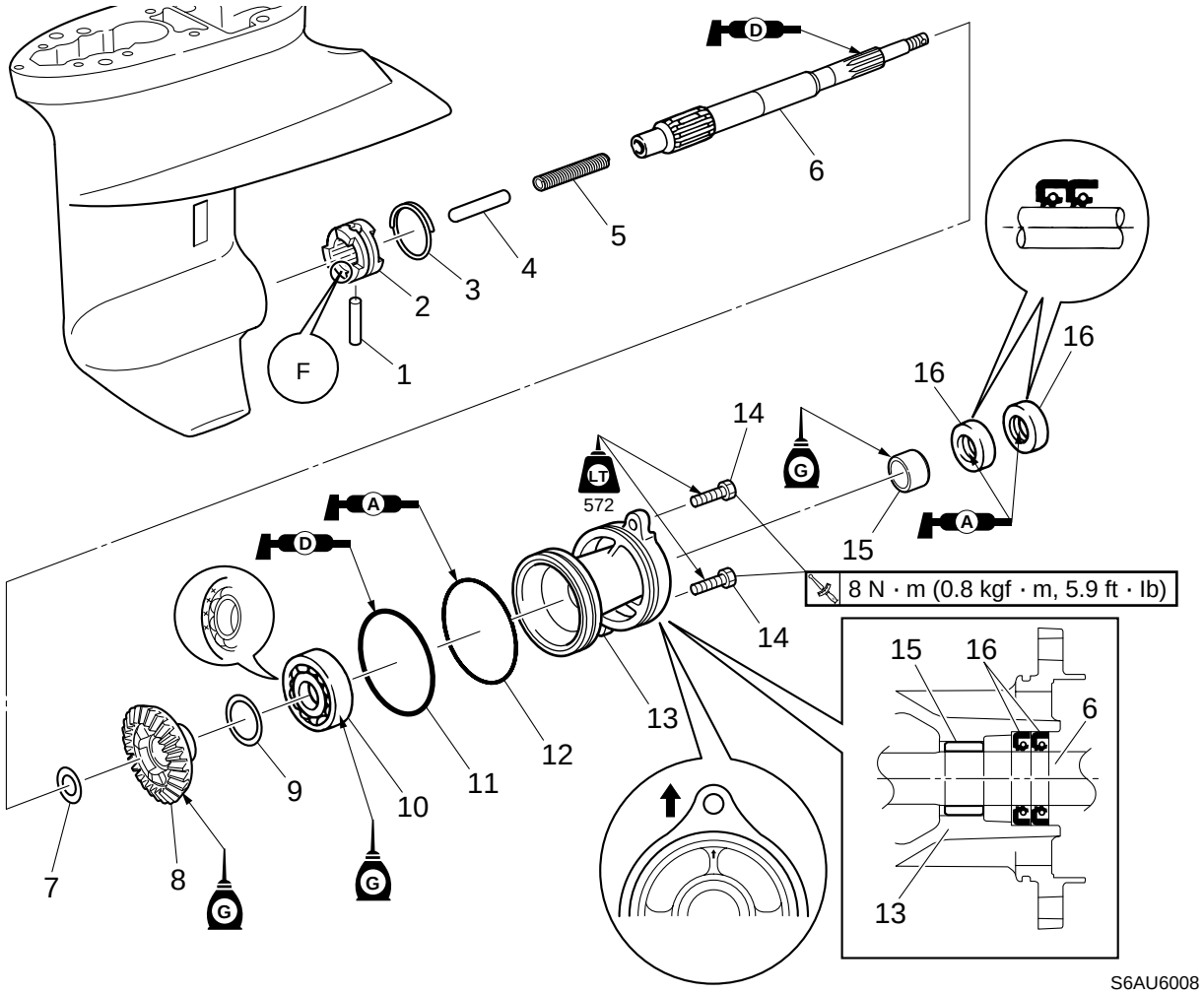
1. Check the water pump housing. Replace if deformed.

NOTE:
If the engine overheated, the inside of the water pump housing may be deformed, therefore be sure to remove the insert cartridge when checking the housing.

2. Check the impeller, insert cartridge, and outer plate cartridge. Replace if cracked or worn.

3. Check the Woodruff key and the keyway in the drive shaft. Replace if worn or deformed.

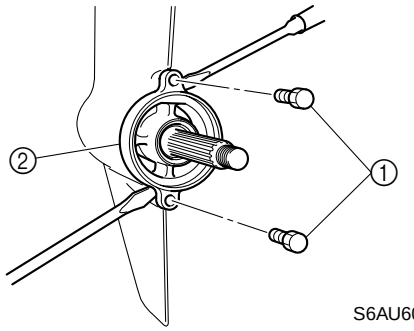
Propeller shaft housing



No.	Part name	Q'ty	Remarks
1	Cross pin	1	
2	Dog clutch	1	
3	Cross pin ring	1	
4	Shift plunger	1	
5	Spring	1	
6	Propeller shaft	1	
7	Washer	1	
8	Reverse gear	1	
9	Reverse gear shim	—	
10	Ball bearing	1	**Not reusable**
11	O-ring	1	**Not reusable**
12	O-ring	1	**Not reusable**
13	Propeller shaft housing	1	
14	Bolt	2	M6 × 16 mm
15	Bushing	1	**Not reusable**
16	Oil seal	2	**Not reusable**

Removing the propeller shaft housing assembly

1. Remove the bolts ① from the propeller shaft housing.
2. Remove the propeller shaft housing assembly ②.

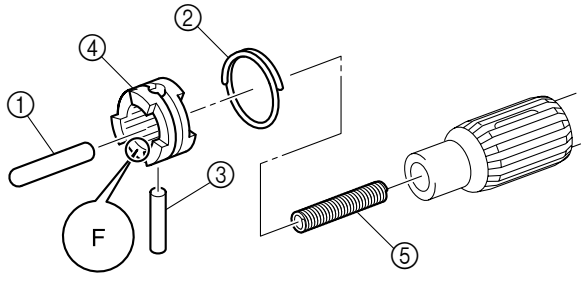


S6AU6009

NOTE:
- Insert flat-head screwdrivers between the propeller shaft housing assembly and the lower case to pry the assembly loose.
- If the propeller shaft housing assembly is stuck to the lower case, use the special service tools. See “Backlash” (6-17).

Disassembling the propeller shaft assembly

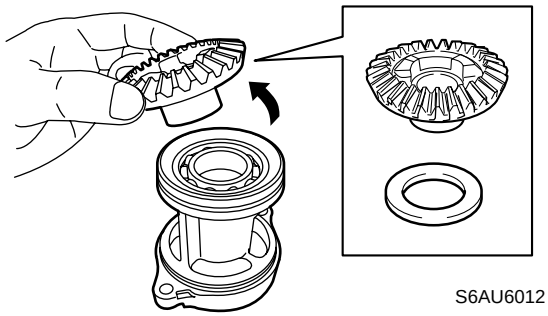
1. Remove the shift plunger ① from the propeller shaft.
2. Remove the cross pin ring ②, and then remove the cross pin ③ and dog clutch ④.
3. Pull out the spring ⑤ from the propeller shaft.



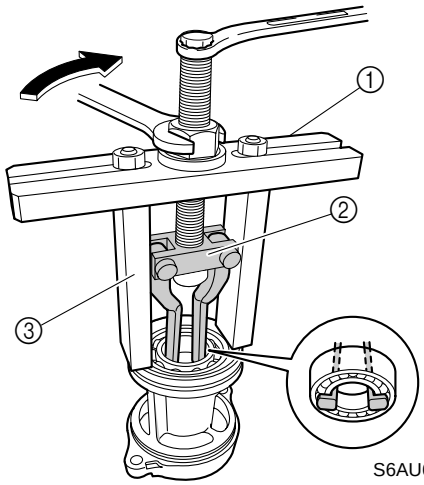
S6AU6011

Disassembling the propeller shaft housing assembly

1. Remove the reverse gear and shim(s).


S6AU6012

2. Remove the ball bearing.

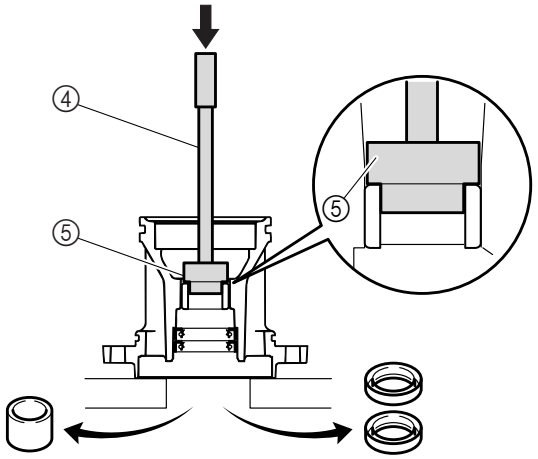


S6AU6014

CAUTION:
Do not reuse the bearing, always replace it with a new one.

Stopper guide plate ①: 90890-06501
Bearing puller assembly ②: 90890-06535
Stopper guide stand ③: 90890-06538

3. Remove the oil seals and bushing.



S6AU6016

CAUTION:

Do not reuse the bushing, always replace it with a new one.

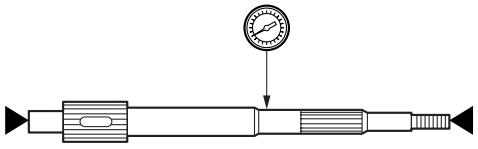
Driver rod L3 ④: 90890-06652
Bushing attachment ⑤:
90890-06649

Checking the propeller shaft housing

1. Clean the propeller shaft housing, and then check it. Replace if cracked or damaged.
2. Check the teeth and dogs of the reverse gear. Replace the reverse gear if cracked or worn.

Checking the propeller shaft

1. Check the propeller shaft. Replace if damaged or worn.
2. Measure the propeller shaft runout. Replace if above specification.



S6AG6130

Propeller shaft runout limit:
0.05 mm (0.0020 in)

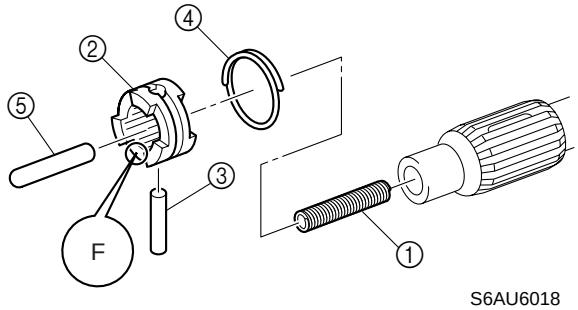
3. Check the dog clutch, shift plunger, and cross pin. Replace if cracked or worn.

Assembling the propeller shaft assembly

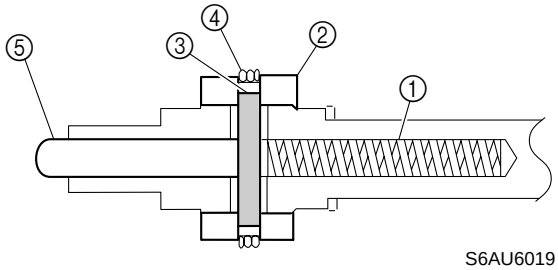
1. Insert the spring ① into the propeller shaft.
2. Install the dog clutch ②, cross pin ③, and cross pin ring ④.

NOTE:
Install the dog clutch with the “F” mark facing toward the forward gear.

3. Install the shift plunger ⑤.



S6AU6018

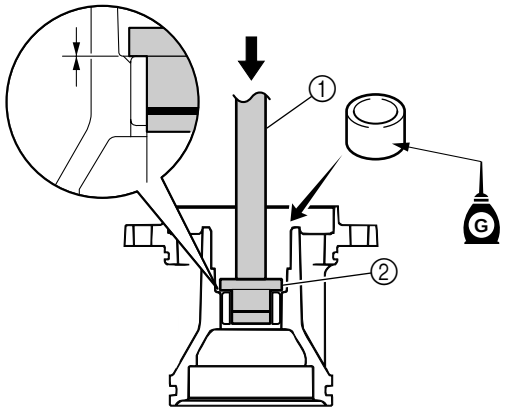


S6AU6019

6

Assembling the propeller shaft housing

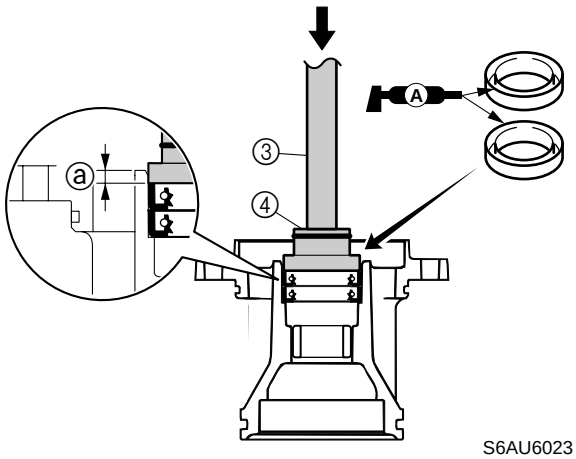
1. Install a new bushing into the propeller shaft housing to the specified depth.



S6AU6021

Driver rod L3 ①: 90890-06652
Needle bearing attachment ②: 90890-06617

2. Apply grease to new oil seals, and then install them into the propeller shaft housing to the specified depth ⓐ.



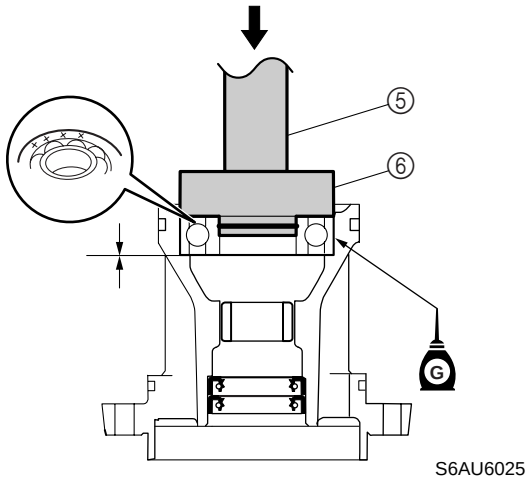
S6AU6023

NOTE:
Install an oil seal halfway into the propeller shaft housing, and then install the other oil seal.

Driver rod L3 ③: 90890-06652
Needle bearing attachment ④: 90890-06614

Installation depth ⓐ: 3.0–3.5 mm (0.12–0.14 in)

3. Install a new ball bearing into the propeller shaft housing.

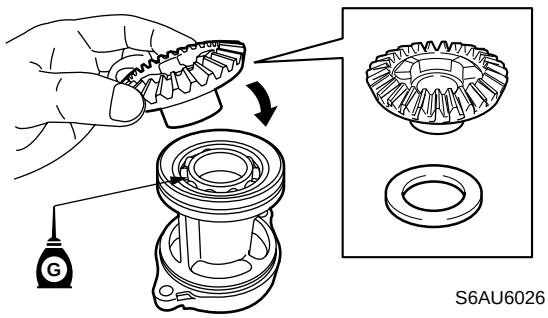


S6AU6025

NOTE:
Install the ball bearing with the manufacture identification mark facing toward the reverse gear.

Driver rod LS ⑤: 90890-06606
Ball bearing attachment ⑥: 90890-06634

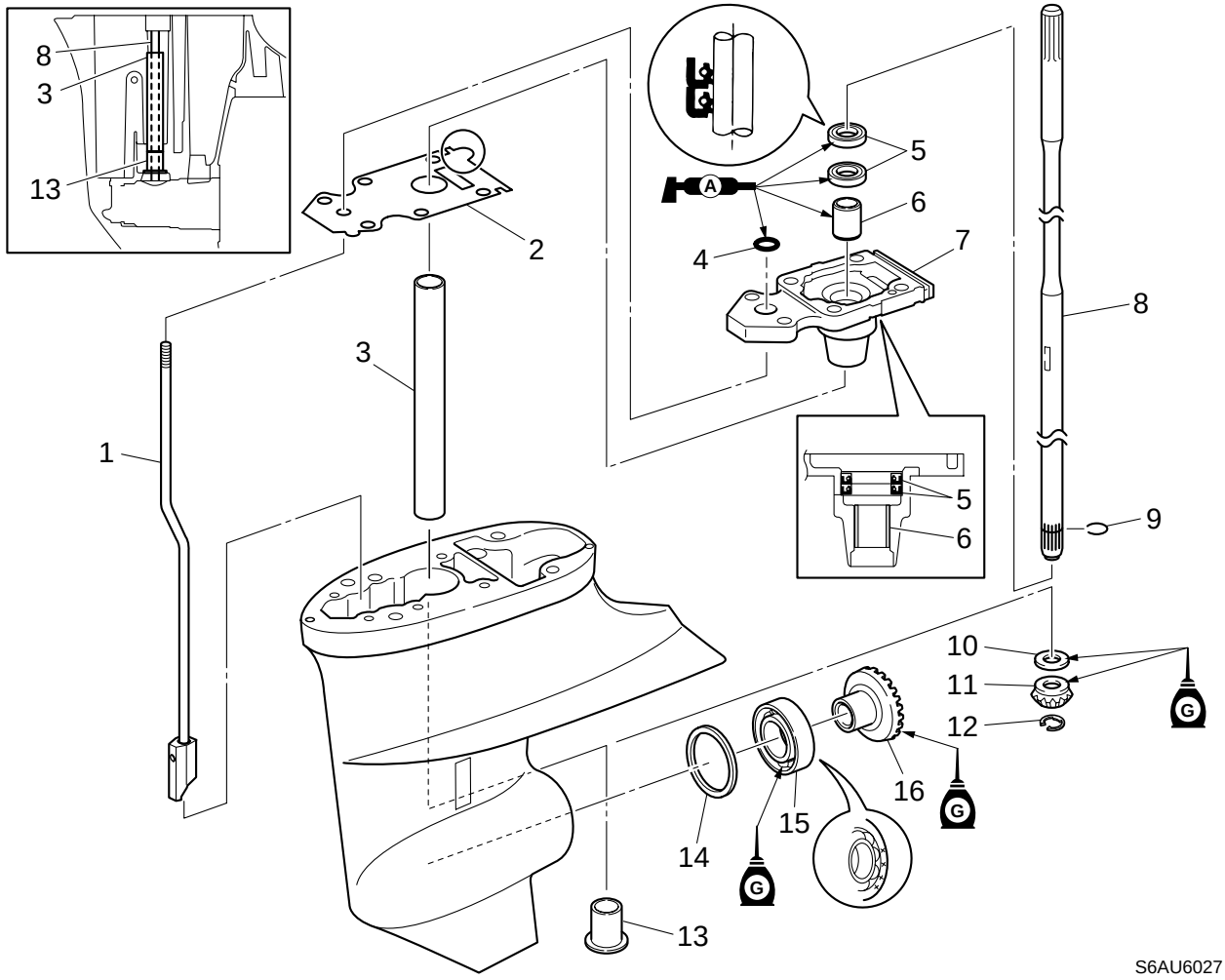
4. Install the reverse gear and original shim(s) into the propeller shaft housing.



S6AU6026

NOTE:
After installing the reverse gear and shim(s), check that the gear rotates smoothly.

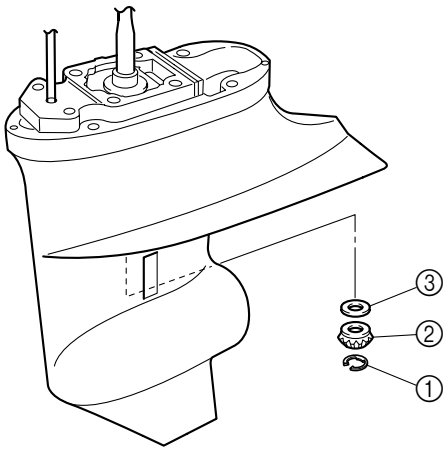
Drive shaft and lower case



No.	Part name	Q'ty	Remarks
1	Shift rod	1	L-transom model/S-transom model
2	Gasket	1	**Not reusable**
3	Drive shaft sleeve	1	
4	O-ring	1	**Not reusable**
5	Oil seal	2	**Not reusable**
6	Bushing	1	
7	Drive shaft housing	1	
8	Drive shaft	1	L-transom model/S-transom model
9	Clip	1	
10	Thrust washer	1	
11	Pinion	1	
12	E-clip	1	
13	Bushing	1	**Not reusable**
14	Forward gear shim	—	
15	Ball bearing	1	**Not reusable**
16	Forward gear	1	

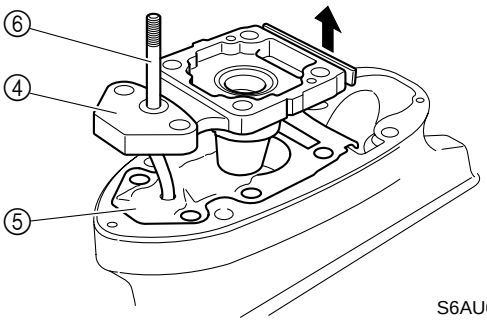
Removing the drive shaft, drive shaft housing, and shift rod

1. Remove the E-clip ①, pinion ②, and thrust washer ③.



S6AU6028

2. Remove the drive shaft, drive shaft housing assembly ④, gasket ⑤, and shift rod ⑥.



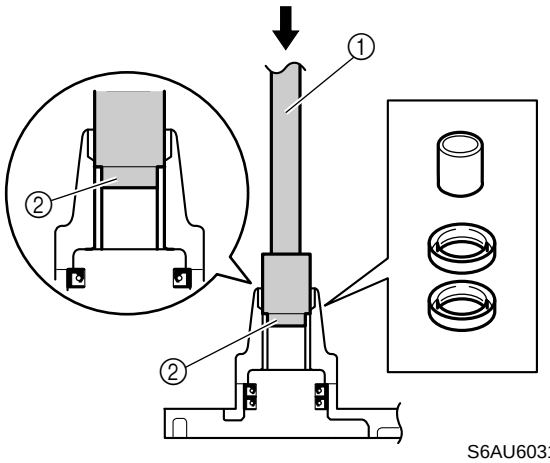
S6AU6029

3. Remove the drive shaft sleeve.

4. Pull out the forward gear.

Disassembling the drive shaft housing

1. Remove the oil seals and bushing.

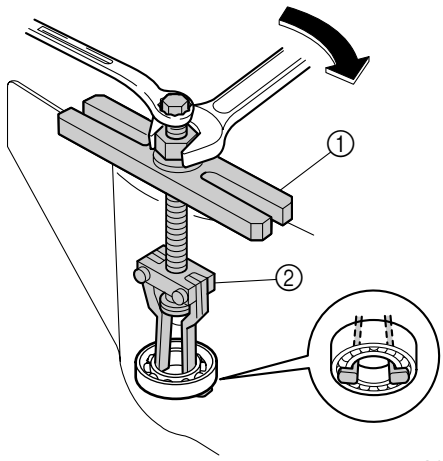


S6AU6031

Driver rod L3 ①: 90890-06652
Bushing attachment ②:
90890-06650

Disassembling the lower case

1. Remove the ball bearing and forward gear shim(s).



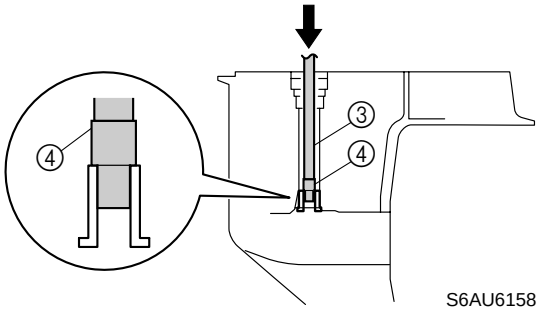
S6AU6035

CAUTION:

Do not reuse the bearing, always replace it with a new one.

Stopper guide plate ①: 90890-06501
Bearing puller assembly ②:
90890-06535

2. Remove the bushing from the lower case.



S6AU6158

CAUTION:
Do not reuse the bushing, always replace it with a new one.

Driver rod L3 ③: 90890-06652
Bushing attachment ④:
90890-06650

Checking the pinion and forward gear

1. Check the teeth of the pinion, and the teeth and dogs of the forward gear. Replace the pinion or forward gear if cracked or worn.

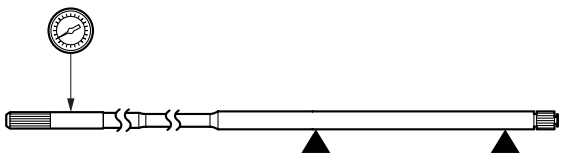
Checking the bearing

1. Check the bearings. Replace if pitted or if there is rumbling.

Checking the drive shaft

1. Check the drive shaft. Replace if bent or worn.

2. Measure the drive shaft runout. Replace if above specification.


S6AU6037

Drive shaft runout limit:
1.0 mm (0.0394 in)

Checking the shift rod

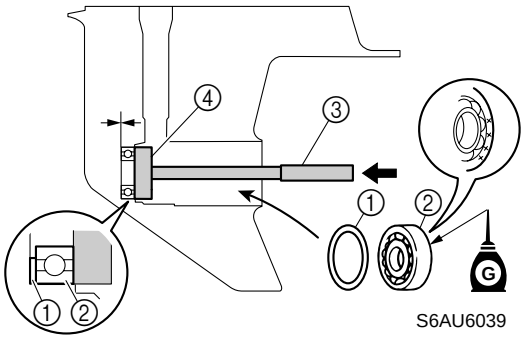
1. Check the shift rod. Replace if bent or worn.

Checking the lower case

1. Check the skeg, torpedo, and anti-cavitation plate. Replace the lower case if cracked or damaged.

Assembling the lower case

1. Install the original forward gear shim(s) ① and a new ball bearing ②.



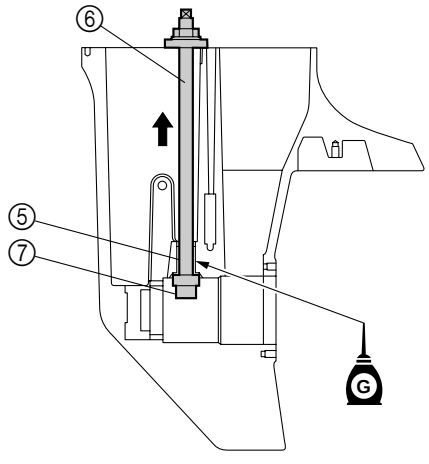
S6AU6039

NOTE:
Install the ball bearing with the manufacture identification mark facing toward the forward gear.

Driver rod LL ③: 90890-06605
Ball bearing attachment ④:
90890-06634

6

2. Install a new bushing ⑤ into the lower case.



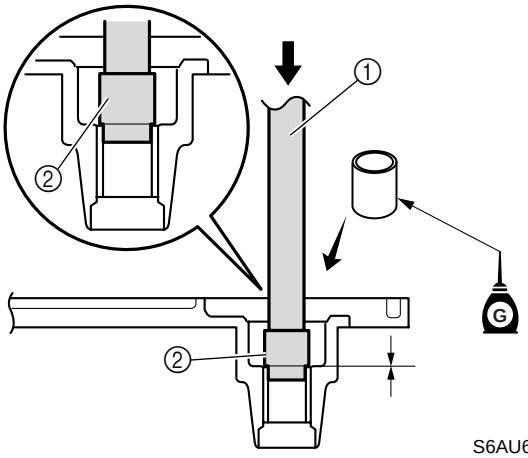
S6AU6041

NOTE:
Install the bushing until its flange is in tight contact with the lower case.

Bushing installer center bolt ⑥: 90890-06601
Needle bearing attachment ⑦: 90890-06616

Assembling the drive shaft housing

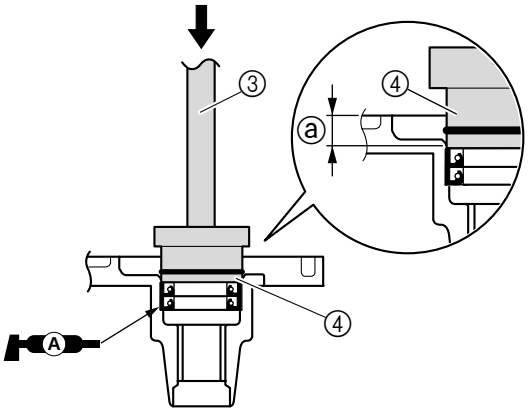
1. Install the bushing into the drive shaft housing.



S6AU6045

Driver rod L3 ①: 90890-06652
Bushing attachment ②: 90890-06650

2. Apply grease to new oil seals, and then install them into the drive shaft housing to the specified depth.



S6AU6047

NOTE:
Install an oil seal halfway into the drive shaft housing, and then install the other oil seal.

Driver rod L3 ③: 90890-06652
Needle bearing attachment ④: 90890-06614

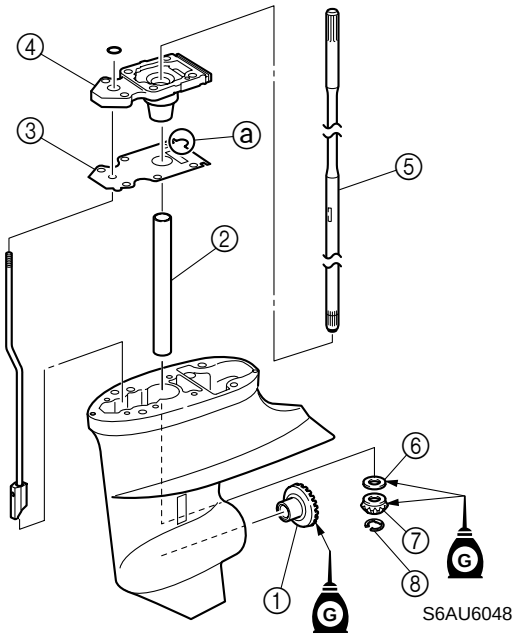
Installation depth ⓐ: 6.0–6.5 mm (0.24–0.26 in)

Installing the shift rod, drive shaft housing, and drive shaft

1. Install the forward gear ① into the lower case.
2. Install the drive shaft sleeve ② into the lower case.
3. Install the shift rod, a new gasket ③, and the drive shaft housing assembly ④.

NOTE:
Make sure that the projection ⓐ on the gasket is toward the starboard side.

4. Install the drive shaft ⑤, thrust washer ⑥, pinion ⑦, and E-clip ⑧ to the drive shaft.

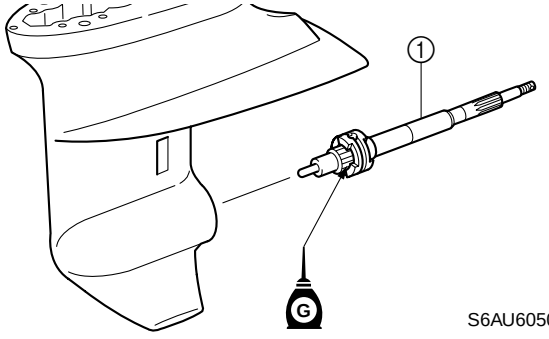


S6AU6048

NOTE:
When installing the pinion, lift up the drive shaft slightly and align the pinion and shaft splines.

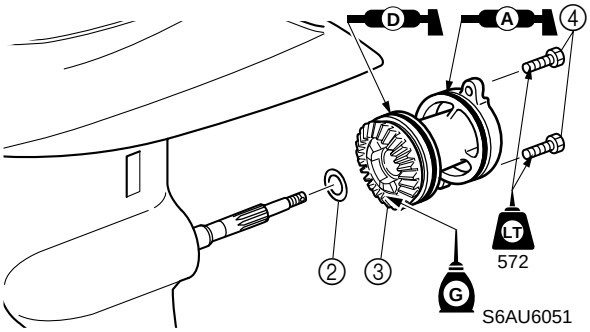
Installing the propeller shaft housing

1. Install the propeller shaft assembly ① into the lower case.

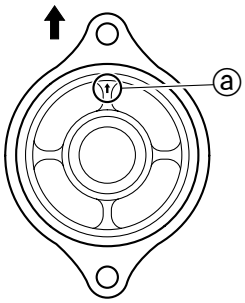


S6AU6050

2. Install the washer ② and propeller shaft housing assembly ③ into the lower case, and then tighten the bolts ④ to the specified torque.



S6AU6051

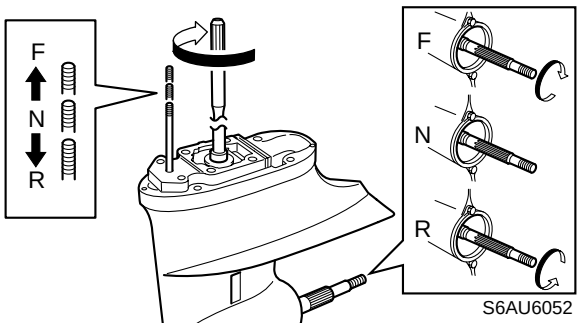


S6AU6157

NOTE:
Install the propeller shaft housing assembly with the arrow mark ⓐ facing upward.

	Propeller shaft housing bolt ④: 8 N·m (0.8 kgf·m, 5.9 ft·lb)

3. Check that the shifting mechanism works properly and smoothly.

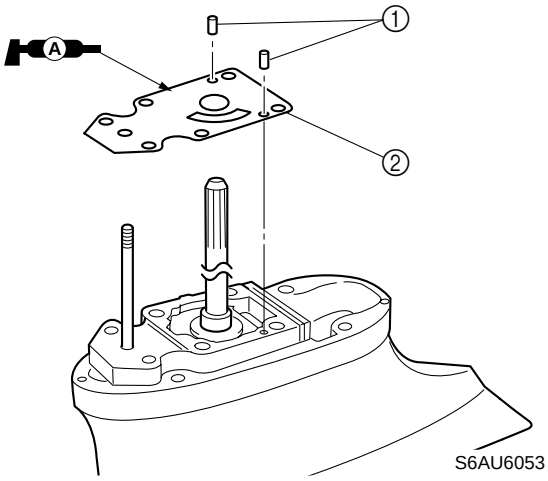


S6AU6052

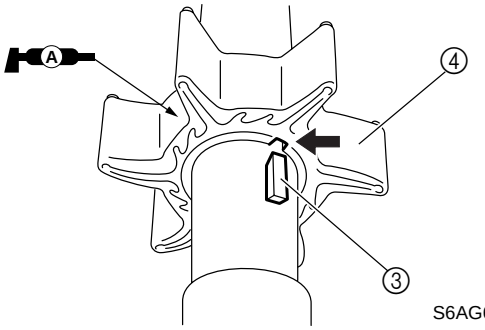
6

Installing the water pump

1. Install the dowels ① and outer plate cartridge ②.

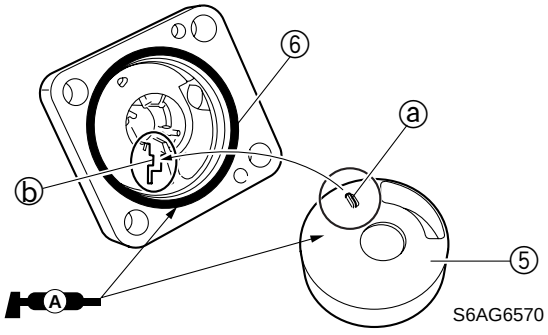


2. Install the Woodruff key ③ and impeller ④ to the drive shaft.



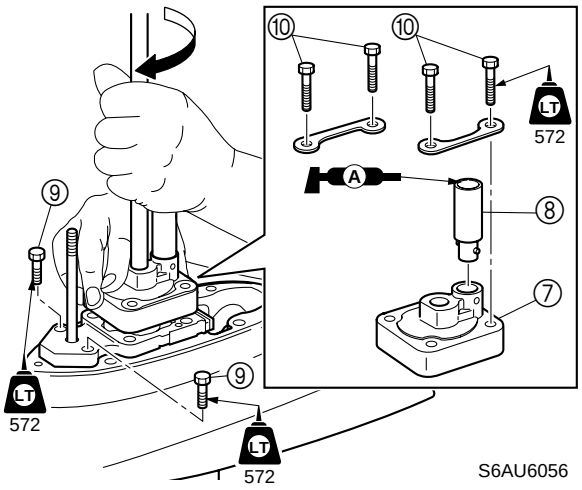
NOTE:
When installing the impeller ④ onto the drive shaft, align the groove in the impeller with the Woodruff key ③.

3. Install the insert cartridge ⑤ and a new O-ring ⑥ into the water pump housing.



NOTE:
Align the insert cartridge projection ⓐ with the hole ⓑ in the water pump housing.

4. Install the water pump housing assembly ⑦ into the lower case, and then install the rubber seal ⑧.



CAUTION:
Do not turn the drive shaft counterclockwise, otherwise the water pump impeller may be damaged.

NOTE:
- Apply grease to the inside of the water pump housing.
- While turning the drive shaft clockwise, push down on the water pump housing and install it.
- Align the projections on the rubber seal ⑧ with the holes in the water pump housing.

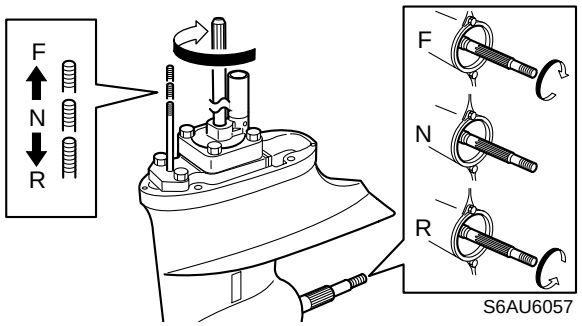
5. Tighten the water pump housing bolts ⑨ and ⑩ to the specified torque.

	Water pump housing bolt ⑨ and ⑩: 18 N·m (1.8 kgf·m, 13.3 ft·lb)

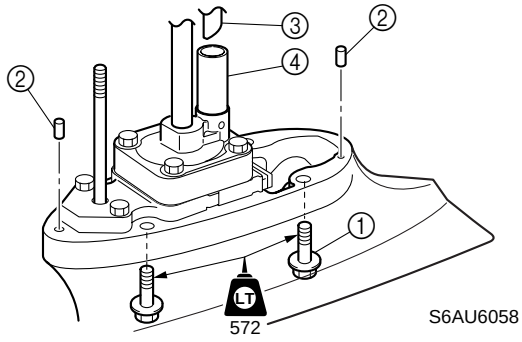
Installing the lower unit

1. Set the shift lever to the R position. (H model)
   Set the remote control lever to the R position. (R model)

2. Set the shift rod to the R position.



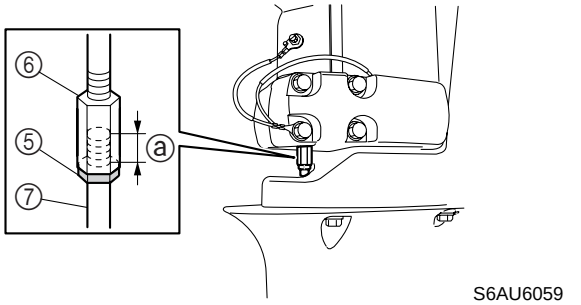
3. Install the lower unit to the upper case, and then tighten the lower case mounting bolts ① to the specified torque.



NOTE:
- Before installing the lower unit to the upper case, install the dowels ② into the lower case.
- Before installing the lower unit, make sure that the locknut is removed from the shift rod.
- When installing the lower unit, make sure that the water pipe ③ is inserted securely into the rubber seal ④.

Lower case mounting bolt ①:
18 N·m (1.8 kgf·m, 13.3 ft·lb)

4. Install the locknut ⑤, and then screw the adjusting nut ⑥ onto the shift rod ⑦.

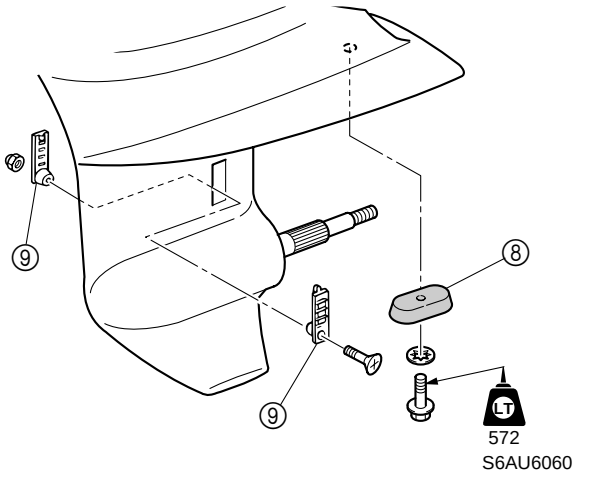


Screwed-in length ⓐ:
8.0–9.0 mm (0.31–0.35 in)

5. Tighten the locknut ⑤.

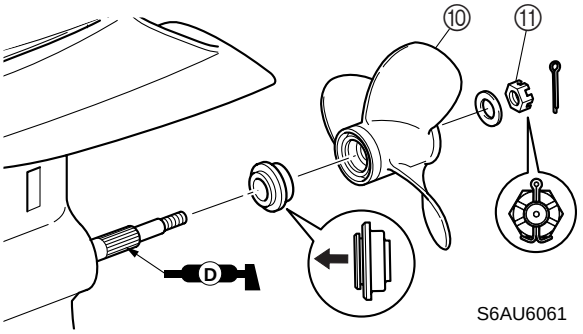
NOTE:
After connecting the shift rod, check that the gear shift operates properly.

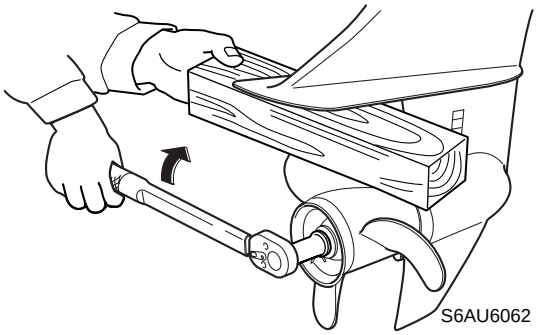
6. Install the anode ⑧ and cooling water inlet covers ⑨, and then tighten the anode bolt to the specified torque.



Anode bolt:
8 N·m (0.8 kgf·m, 5.9 ft·lb)

7. Install the propeller ⑩ and propeller nut ⑪. Place a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning, and then tighten the nut to the specified torque.





⚠ WARNING

- **Do not hold the propeller with your hands when loosening or tightening it.**
- **Be sure to disconnect the battery cables from the battery and remove the clip from the engine shut-off switch. (E model)**

NOTE:
If the grooves in the propeller nut do not align with the cotter pin hole, tighten the nut until they are aligned.

Propeller nut:
17 N·m (1.7 kgf·m, 12.5 ft·lb)

8. Fill the lower unit with gear oil to the correct level.

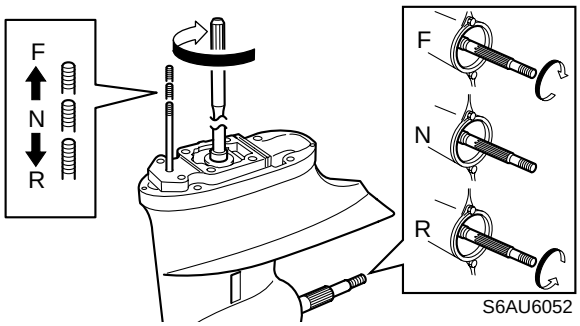
Recommended gear oil:
Hypoid gear oil
API: GL-4
SAE: 90
Gear oil quantity:
150 cm^3
(5.07 US oz, 5.29 Imp oz)

Backlash

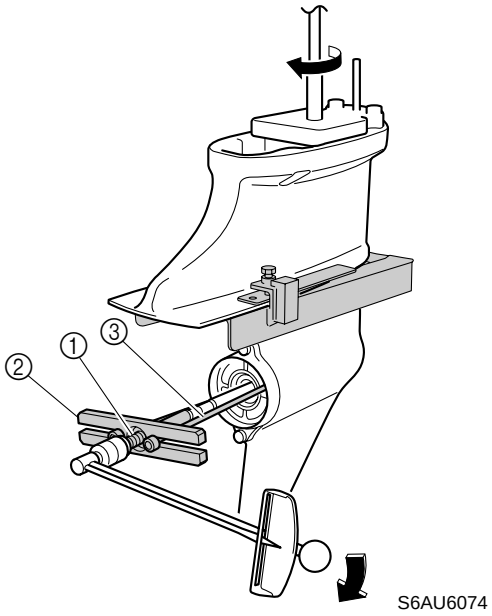
Measuring the forward and reverse gear backlash

NOTE:
Remove the water pump assembly before measuring the backlash.

1. Install the lower unit onto a repair stand.
2. Set the shift rod to the N position at the lower unit.



3. Install the special service tools.
4. Tighten the center bolt ① to the specified torque while turning the drive shaft.



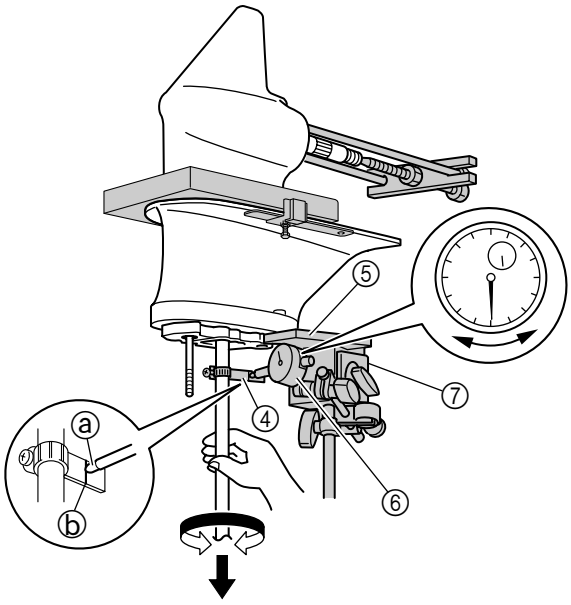
S6AU6074

Center bolt ①: 90890-06504
Stopper guide plate ②: 90890-06501
Bearing housing puller claw S ③:
90890-06564

Center bolt ①:
2 N·m (0.2 kgf·m, 1.5 ft·lb)

5. Turn the lower unit upside down.

6. Install the backlash indicator onto the drive shaft (11.8 mm [0.46 in] in diameter), and then install the dial gauge.



S6AU6076

NOTE:
Install the dial gauge so that the plunger tip ⓐ is aligned with the mark ⓑ on the backlash indicator.

Backlash indicator ④: 90890-06706
Magnet base plate ⑤: 90890-07003
Dial gauge set ⑥: 90890-01252
Magnet base B ⑦: 90890-06844

7. Slowly turn the drive shaft clockwise and counterclockwise and measure the backlash when the drive shaft stops in each direction.

NOTE:
- Pull the drive shaft downward, and then turn it.
- Measure the backlash at 4 points to find the average.

Forward gear backlash:
0.50- 2.27 mm (0.0197- 0.0894 in)

6

8. Adjust the current shim thickness if the forward gear backlash is out of specification.

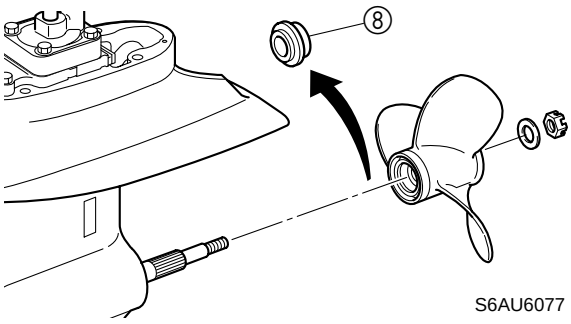
Forward gear backlash	Shim thickness
Less than 0.50 mm (0.0197 in)	To be decreased by (1.39 – M) × 0.40
More than 2.27 mm (0.0894 in)	To be increased by (M – 1.39) × 0.40

M: Measurement

Available shim thicknesses:
0.10, 0.12, 0.15, 0.18, and 0.30 mm

9. Remove the special service tools from the propeller shaft.

10. Install the propeller, washer, and propeller nut, without installing the spacer ⑧.

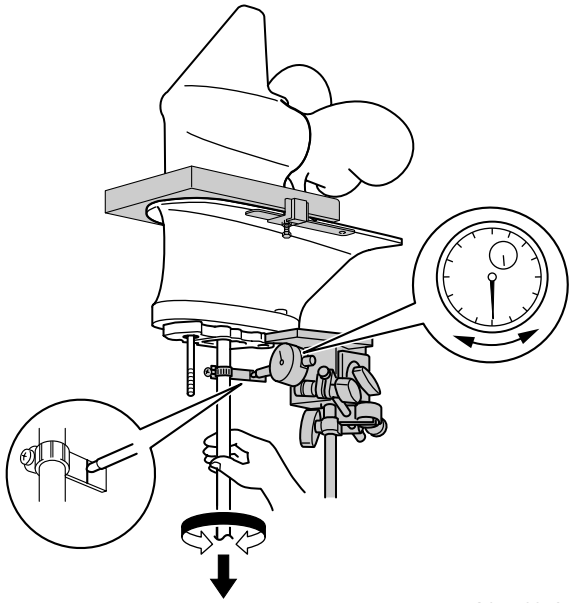


S6AU6077

11. Tighten the propeller nut to the specified torque.

Propeller nut:
2 N·m (0.2 kgf·m, 1.5 ft·lb)

12. Slowly turn the drive shaft clockwise and counterclockwise and measure the backlash when the drive shaft stops in each direction.


S6AU6078

NOTE:
- Pull the drive shaft downward, and then turn it.
- Measure the backlash at 4 points to find the average.

Reverse gear backlash:
0.50–2.27 mm (0.0197–0.0894 in)

13. Adjust the current shim thickness if the reverse gear backlash is out of specification.

Reverse gear backlash	Shim thickness
Less than 0.50 mm (0.0197 in)	To be decreased by (1.39 – M) × 0.40
More than 2.27 mm (0.0894 in)	To be increased by (M – 1.39) × 0.40

M: Measurement

Available shim thicknesses: 0.1 mm

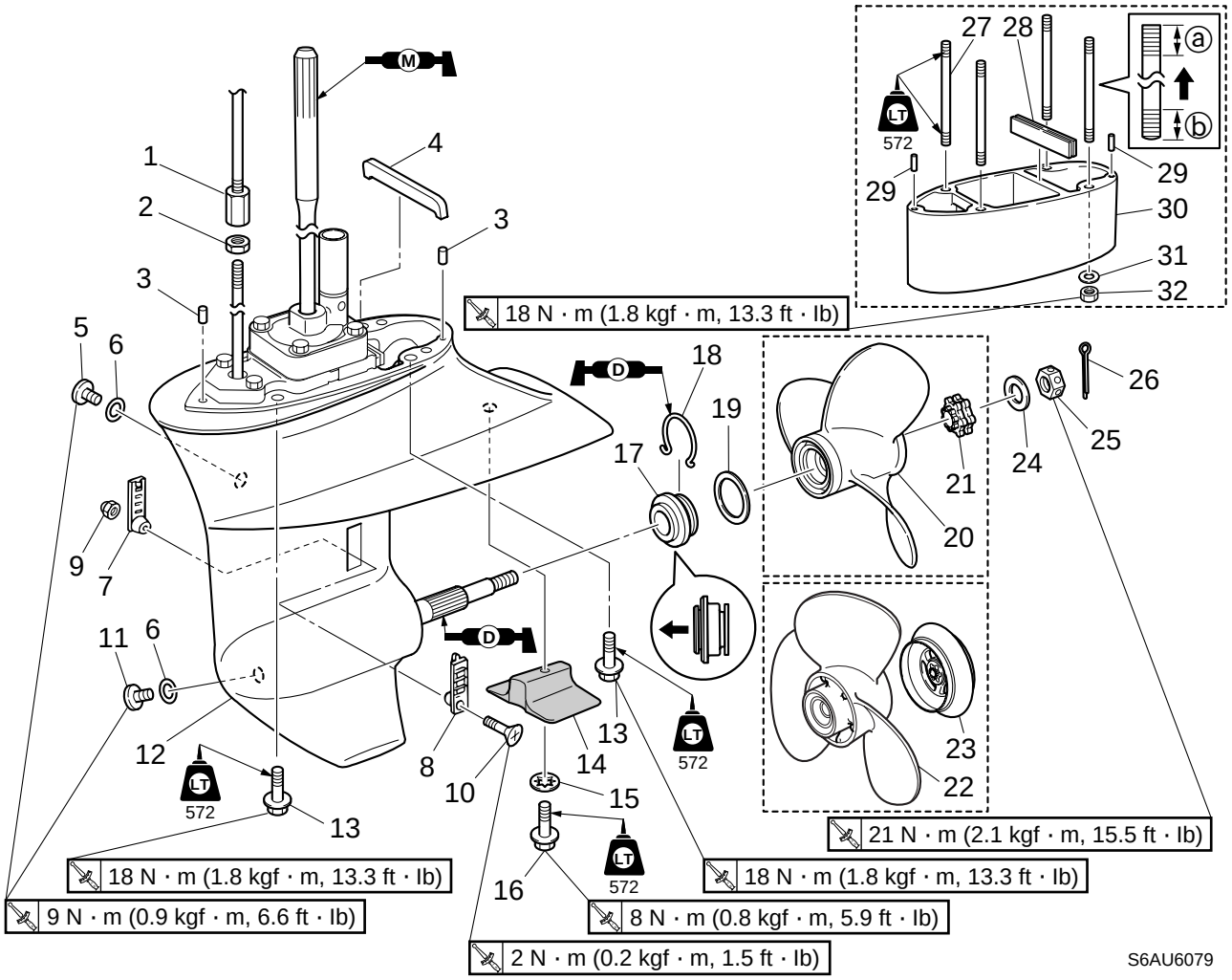
14. Turn the lower unit upright.

15. Remove the special service tools and propeller, and then install the water pump assembly.

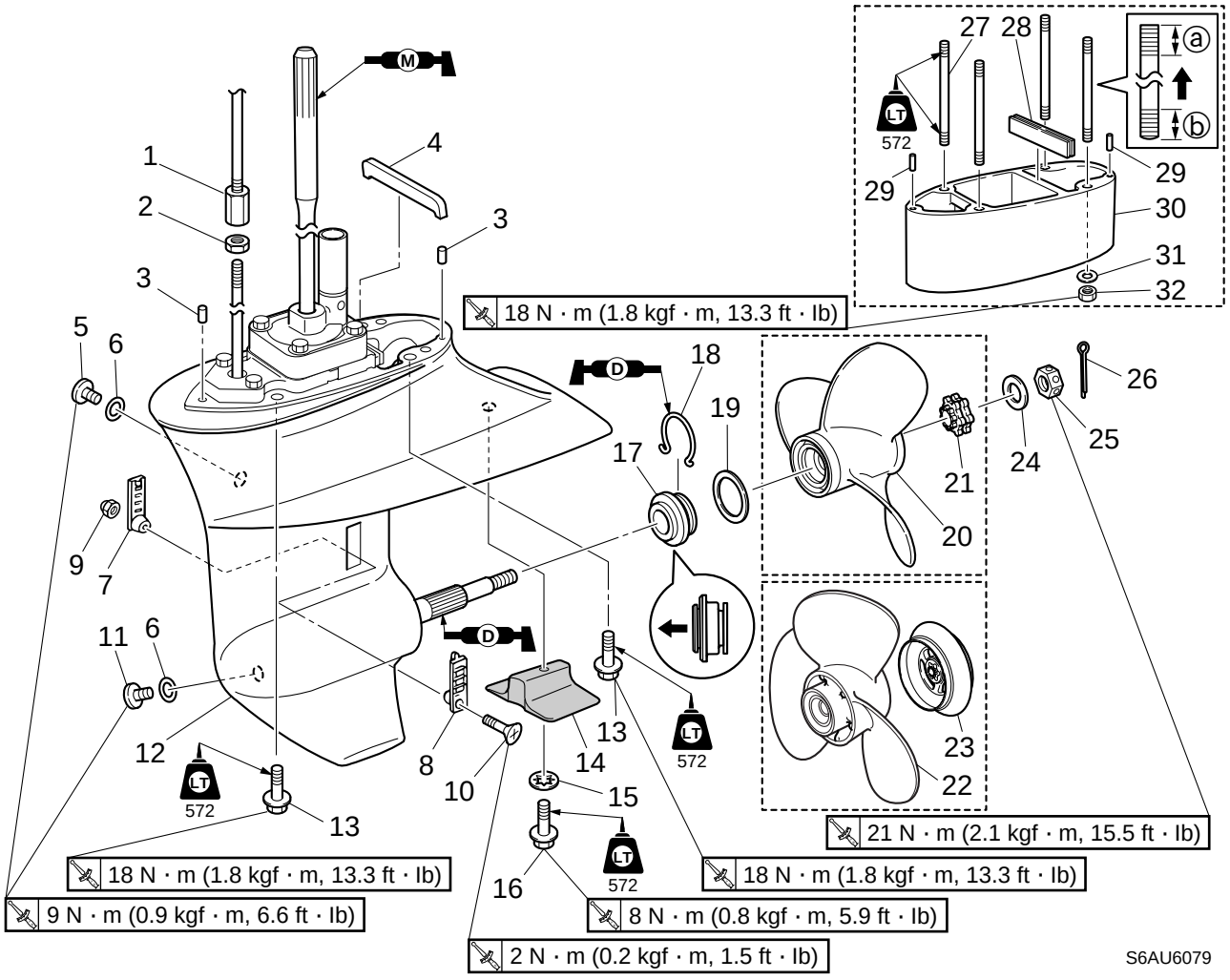
NOTE:
To install the water pump assembly, see “Installing the water pump” (6-15).

16. Fill the lower unit with gear oil to the correct level.

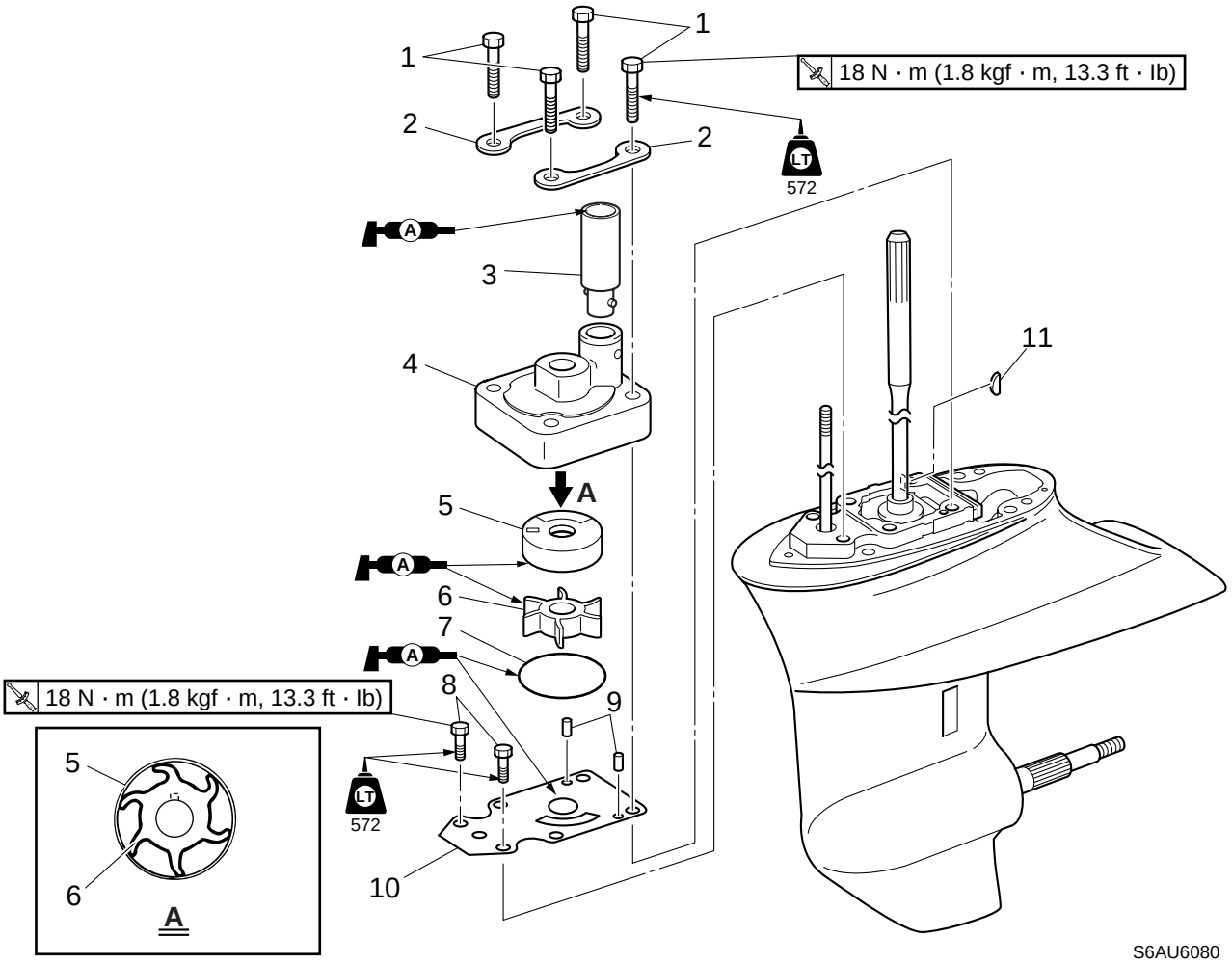
Lower unit (high thrust model)



No.	Part name	Q'ty	Remarks
1	Adjusting nut	1	
2	Locknut	1	
3	Dowel	2	
4	Rubber seal	1	
5	Check screw	1	
6	Gasket	2	**Not reusable**
7	Cooling water inlet cover	1	
8	Cooling water inlet cover	1	
9	Nut	1	
10	Screw	1	ø5 × 20 mm
11	Drain screw	1	
12	Lower case	1	
13	Bolt	4	M8 × 30 mm/L-transom model
14	Anode	1	
15	Special washer	1	**Not reusable**
16	Bolt	1	M6 × 30 mm
17	Spacer	1	


18 N · m (1.8 kgf · m, 13.3 ft · lb)
21 N · m (2.1 kgf · m, 15.5 ft · lb)
18 N · m (1.8 kgf · m, 13.3 ft · lb)
9 N · m (0.9 kgf · m, 6.6 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
2 N · m (0.2 kgf · m, 1.5 ft · lb)
572
S6AU6079

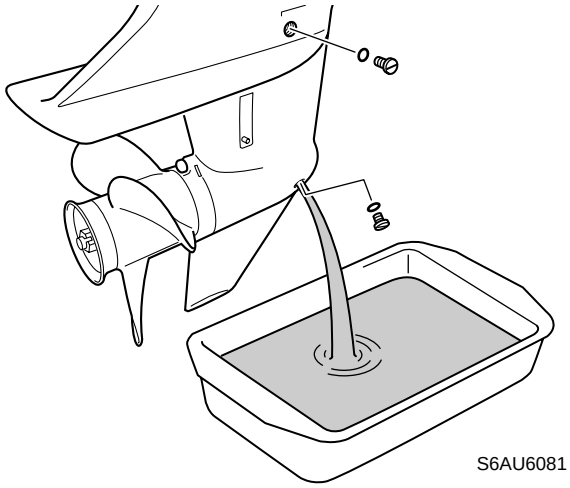
No.	Part name	Q'ty	Remarks
18	Clip	1	
19	Washer	1	
20	Propeller	1	
21	Spacer	1	
22	Propeller	1	
23	Deflector	1	
24	Washer	1	
25	Propeller nut	1	
26	Cotter pin	1	**Not reusable**
27	Stud bolt	4	ⓐ > ⓑ/X-transom model
28	Rubber seal	1	X-transom model
29	Dowel	2	X-transom model
30	Extension	1	X-transom model
31	Washer	4	X-transom model
32	Nut	4	X-transom model



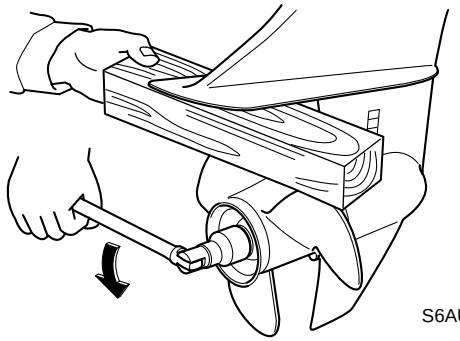
No.	Part name	Q'ty	Remarks
1	Bolt	4	M8 × 45 mm
2	Plate	2	
3	Rubber seal	1	
4	Water pump housing	1	
5	Insert cartridge	1	
6	Impeller	1	
7	O-ring	1	**Not reusable**
8	Bolt	2	M8 × 25 mm
9	Dowel	2	
10	Outer plate cartridge	1	
11	Woodruff key	1	

Removing the lower unit

1. Drain the gear oil.


S6AU6081

2. Set the gear shift to the N position, place a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning, and then remove the propeller nut and propeller.


S6AU6004

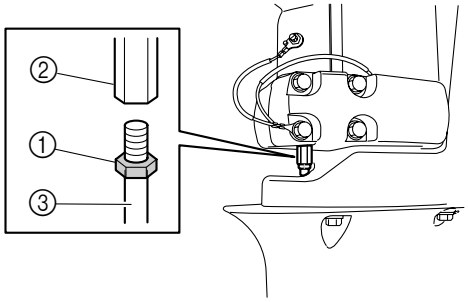
⚠ WARNING

- **Do not hold the propeller with your hands when loosening or tightening it.**
- **Be sure to disconnect the battery cables from the battery and remove the clip from the engine shut-off switch. (E model)**

3. Loosen the locknut ① while holding the adjusting nut ②, and then turn the adjusting nut to disconnect the shift rod ③.

NOTE:
Set the gear shift to the R position before disconnecting the shift rod.

4. Remove the locknut ①.

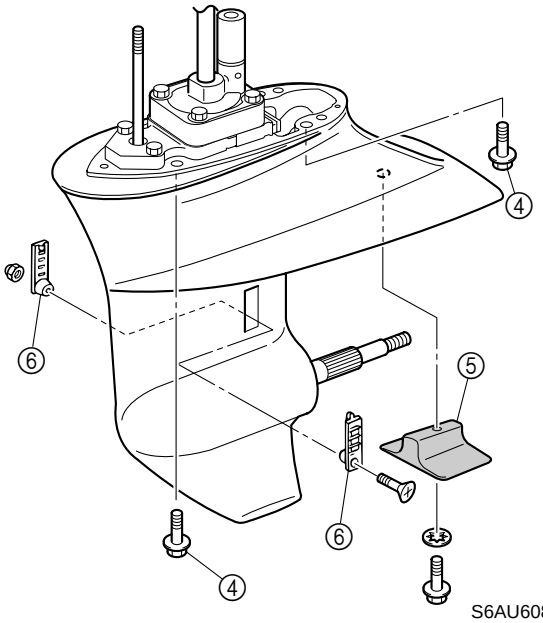


S6AU6005

NOTE:
Be sure to remove the locknut from the shift rod before removing the lower unit.

5. Remove the lower unit by removing the lower case mounting bolts ④.

6. Remove the anode ⑤ and cooling water inlet covers ⑥.



S6AU6084

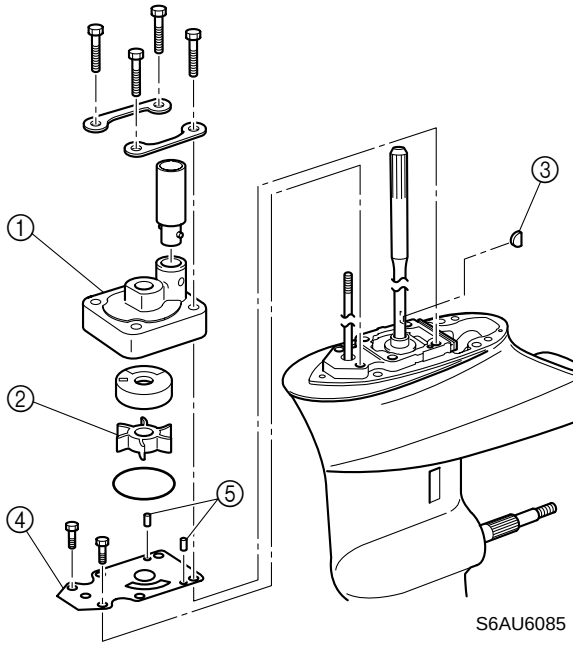
6

Removing the water pump

1. Remove the water pump housing ① and impeller ②.

2. Remove the Woodruff key ③ from the drive shaft, and then remove the outer plate cartridge ④.

3. Remove the dowels ⑤ from the lower case.



Checking the water pump

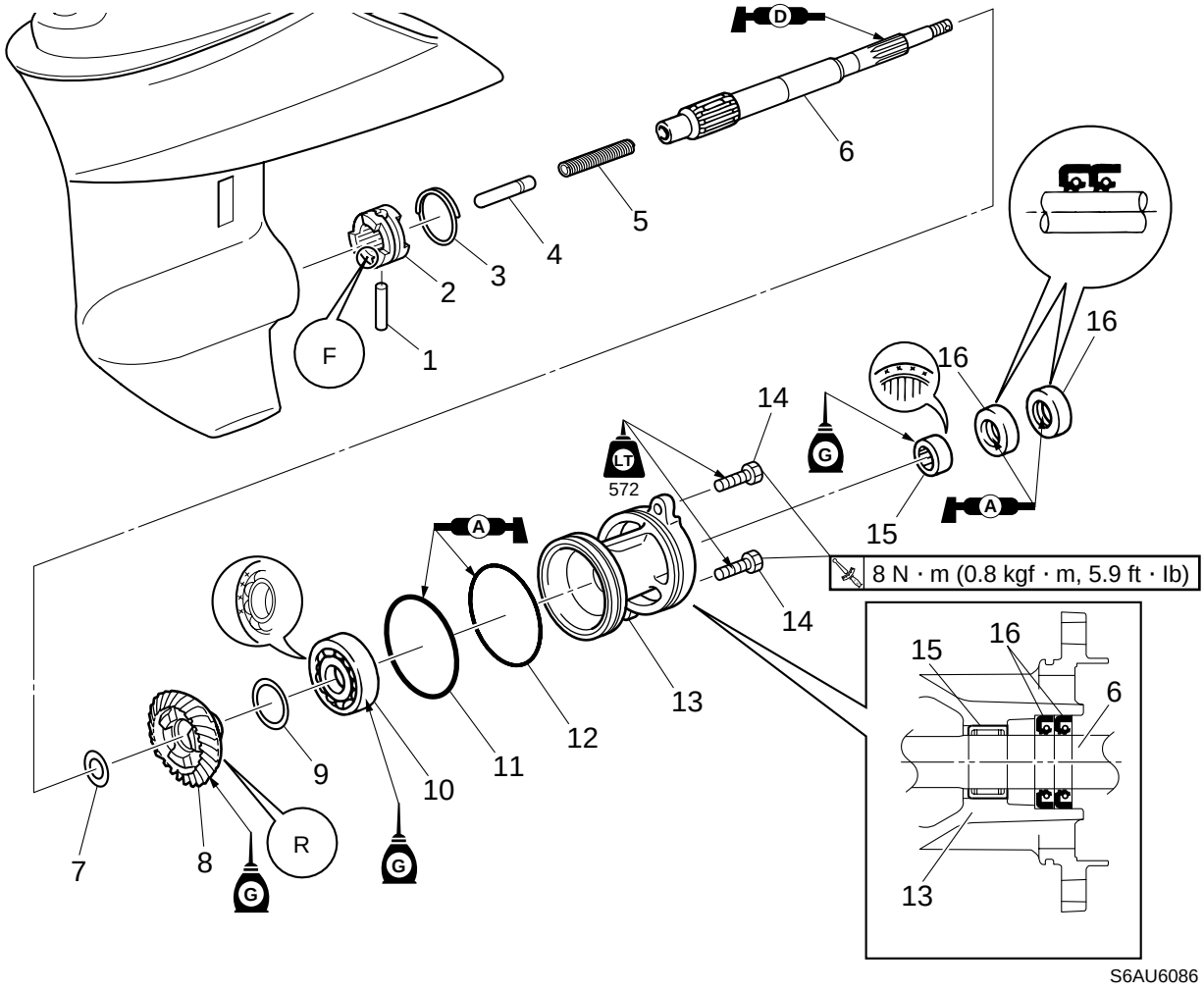
1. Check the water pump housing. Replace if deformed.

NOTE:
If the engine overheated, the inside of the water pump housing may be deformed, therefore be sure to remove the insert cartridge when checking the housing.

2. Check the impeller, insert cartridge, and outer plate cartridge. Replace if cracked or worn.

3. Check the Woodruff key and the keyway in the drive shaft. Replace if worn or deformed.

Propeller shaft housing (high thrust model)

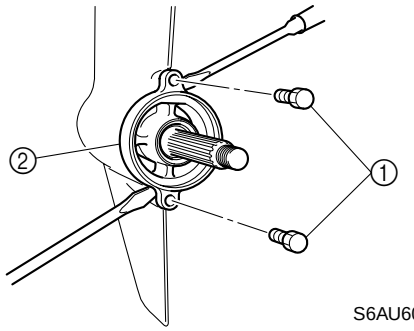


No.	Part name	Q'ty	Remarks
1	Cross pin	1	
2	Dog clutch	1	
3	Cross pin ring	1	
4	Shift plunger	1	
5	Spring	1	
6	Propeller shaft	1	
7	Washer	1	
8	Reverse gear	1	
9	Reverse gear shim	—	
10	Ball bearing	1	**Not reusable**
11	O-ring	1	**Not reusable**
12	O-ring	1	**Not reusable**
13	Propeller shaft housing	1	
14	Bolt	2	M6 × 25 mm
15	Needle bearing	1	**Not reusable**
16	Oil seal	2	**Not reusable**

Removing the propeller shaft housing assembly

1. Remove the bolts ① from the propeller shaft housing.

2. Remove the propeller shaft housing assembly ②.



S6AU6009

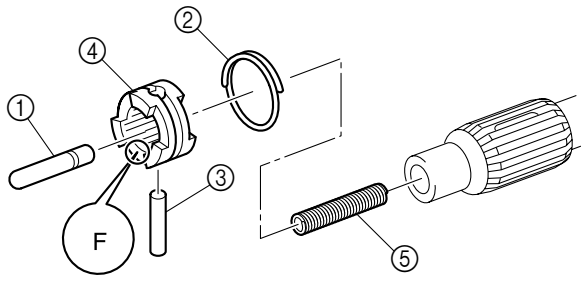
NOTE:
- Insert flat-head screwdrivers between the propeller shaft housing assembly and the lower case to pry the assembly loose.
- If the propeller shaft housing assembly is stuck to the lower case, use the special service tools. See "Backlash (high thrust model)" (6-42).

Disassembling the propeller shaft assembly

1. Remove the shift plunger ① from the propeller shaft.

2. Remove the cross pin ring ②, and then remove the cross pin ③ and dog clutch ④.

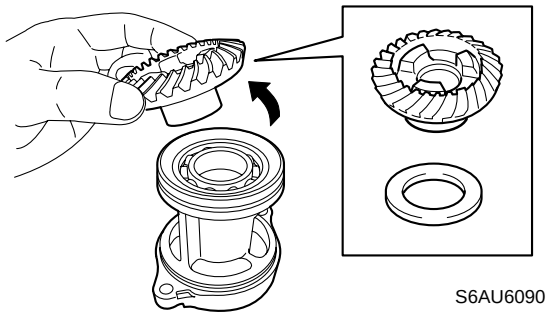
3. Pull out the spring ⑤ from the propeller shaft.



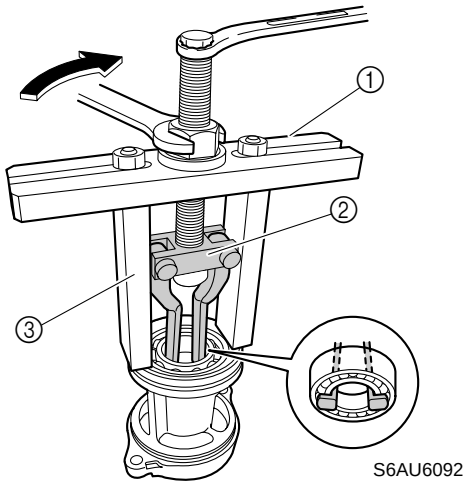
S6AU6089

Disassembling the propeller shaft housing assembly

1. Remove the reverse gear and shim(s).


S6AU6090

2. Remove the ball bearing.

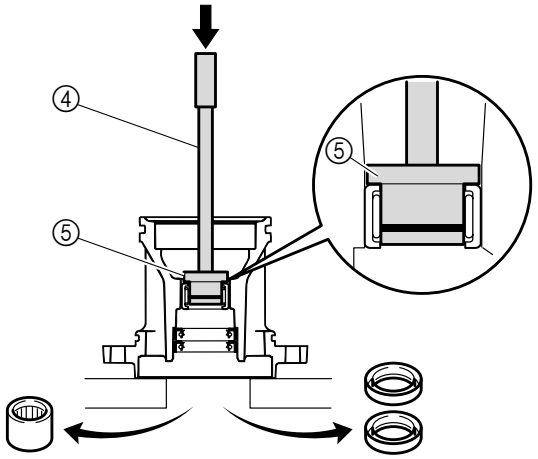


S6AU6092

CAUTION:
Do not reuse the bearing, always replace it with a new one.

Stopper guide plate ①: 90890-06501
Bearing puller assembly ②: 90890-06535
Stopper guide stand ③: 90890-06538

3. Remove the oil seals and needle bearing.



S6AU6094

CAUTION:

Do not reuse the bearing, always replace it with a new one.

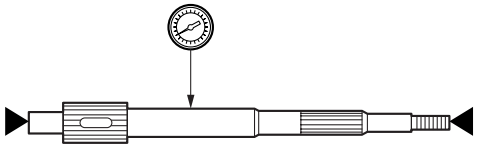
Driver rod L3 ④: 90890-06652
Needle bearing attachment ⑤: 90890-06616

Checking the propeller shaft housing

1. Clean the propeller shaft housing, and then check it. Replace if cracked or damaged.
2. Check the teeth and dogs of the reverse gear. Replace the reverse gear if cracked or worn.

Checking the propeller shaft

1. Check the propeller shaft. Replace if damaged or worn.
2. Measure the propeller shaft runout. Replace if above specification.



S6AU6095

Propeller shaft runout limit:
0.02 mm (0.0008 in)

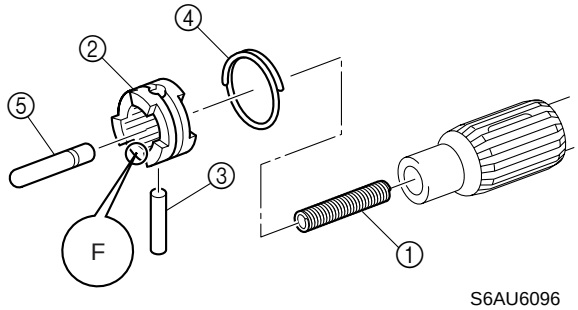
3. Check the dog clutch, shift plunger, and cross pin. Replace if cracked or worn.

Assembling the propeller shaft assembly

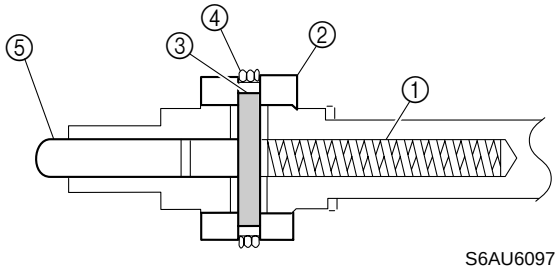
1. Insert the spring ① into the propeller shaft.
2. Install the dog clutch ②, cross pin ③, and cross pin ring ④.

NOTE:
Install the dog clutch with the “F” mark facing toward the forward gear.

3. Install the shift plunger ⑤.



S6AU6096

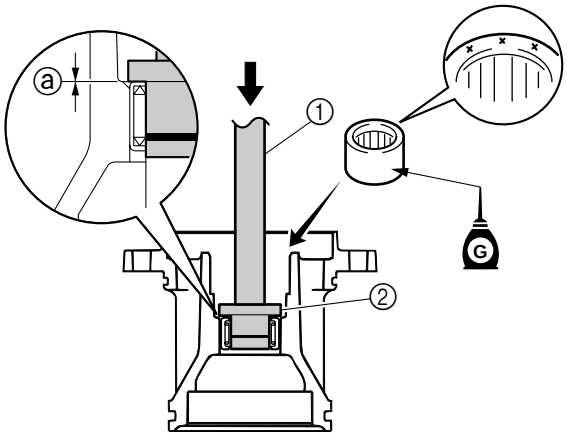


S6AU6097

6

Assembling the propeller shaft housing

1. Install a new needle bearing into the propeller shaft housing to the specified depth ⓐ.



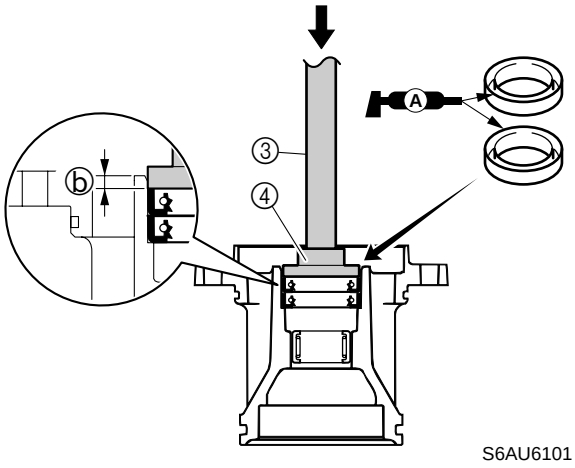
S6AU6099

NOTE:
Install the needle bearing with the manufacture identification mark facing toward the oil seals (propeller side).

Driver rod L3 ①: 90890-06652
Needle bearing attachment ②: 90890-06616

Installation depth ⓐ: 0 ± 0.25 mm (0 ± 0.01 in)

2. Apply grease to new oil seals, and then install them into the propeller shaft housing to the specified depth ⓑ.



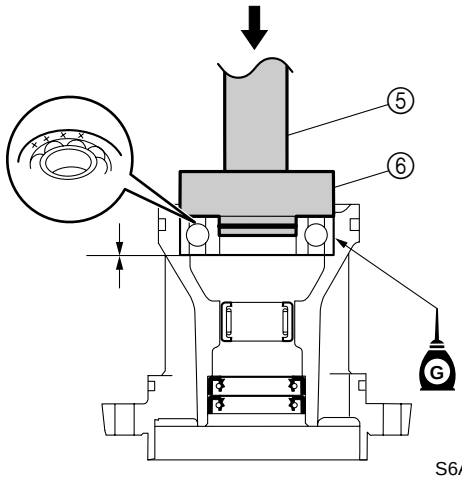
S6AU6101

NOTE:
Install an oil seal halfway into the propeller shaft housing, and then install the other oil seal.

Driver rod L3 ③: 90890-06652
Needle bearing attachment ④: 90890-06613

Installation depth ⓑ: 4.5–5.0 mm (0.18–0.20 in)

3. Install a new ball bearing into the propeller shaft housing.

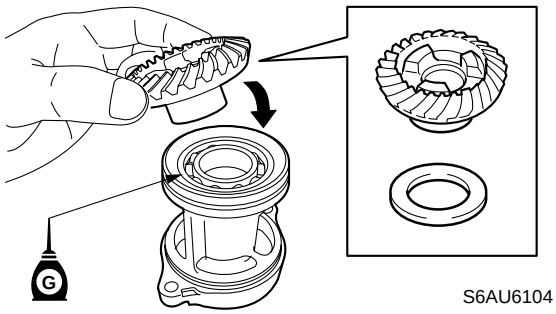


S6AU6103

NOTE:
Install the ball bearing with the manufacture identification mark facing toward the reverse gear.

	Driver rod LS ⑤: 90890-06606 Ball bearing attachment ⑥: 90890-06632

4. Install the reverse gear and original shim(s) into the propeller shaft housing.

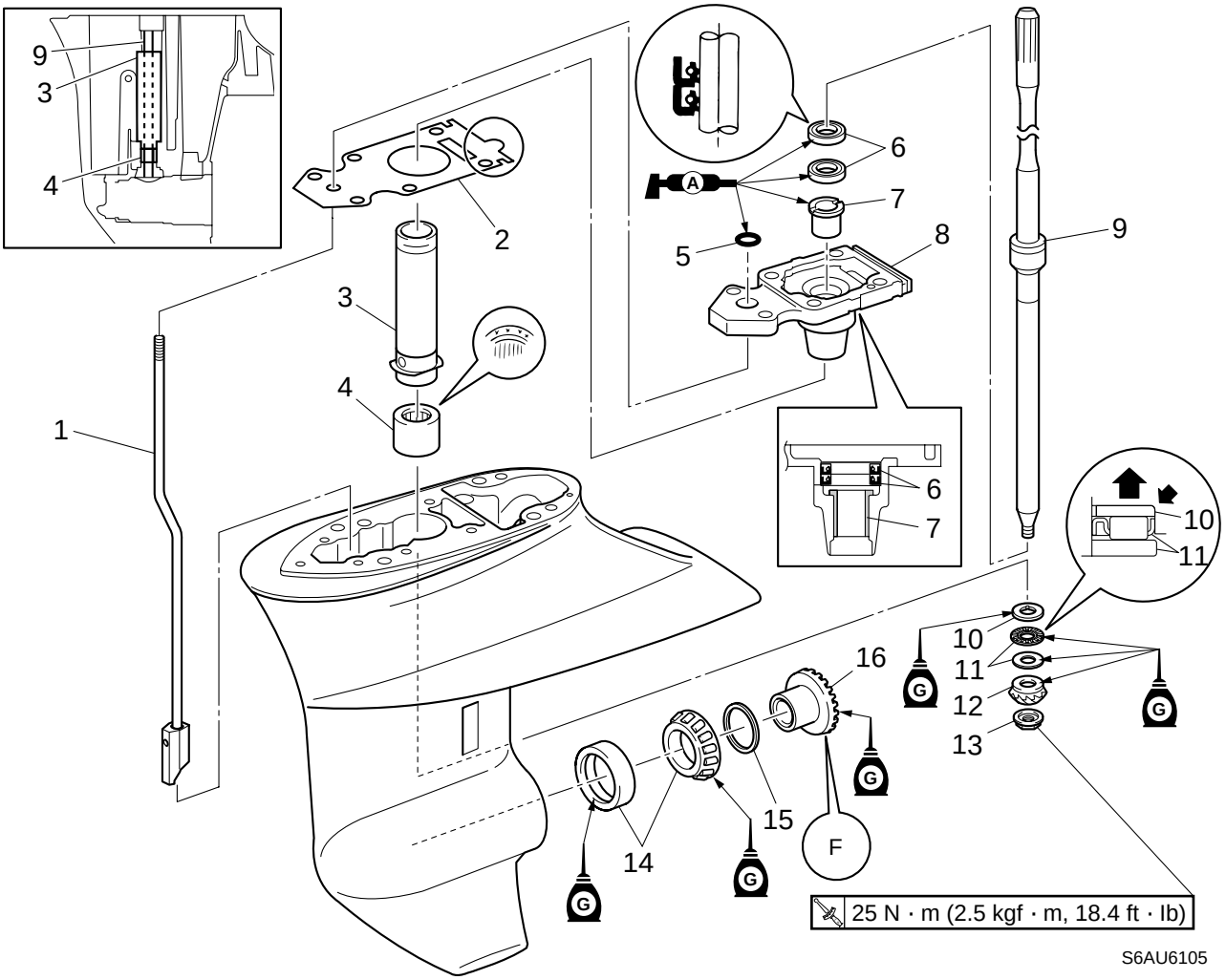


NOTE:

- Be sure to select the reverse gear shim(s) if replacing the propeller shaft housing, ball bearing, or lower case. To select the shims, see “Shimming (high thrust model)” (6-39).
- After installing the reverse gear and shim(s), check that the gear rotates smoothly.

6

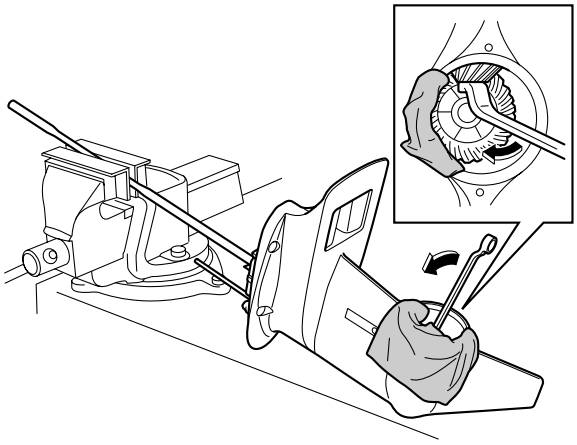
Drive shaft and lower case (high thrust model)



No.	Part name	Q'ty	Remarks
1	Shift rod	1	L-transom model/X-transom model
2	Gasket	1	**Not reusable**
3	Drive shaft sleeve	1	
4	Needle bearing	1	**Not reusable**
5	O-ring	1	**Not reusable**
6	Oil seal	2	**Not reusable**
7	Bushing	1	
8	Drive shaft housing	1	
9	Drive shaft	1	L-transom model/X-transom model
10	Pinion shim	—	
11	Roller bearing	1	
12	Pinion	1	
13	Pinion nut	1	
14	Taper roller bearing	1	**Not reusable**
15	Forward gear shim	—	
16	Forward gear	1	

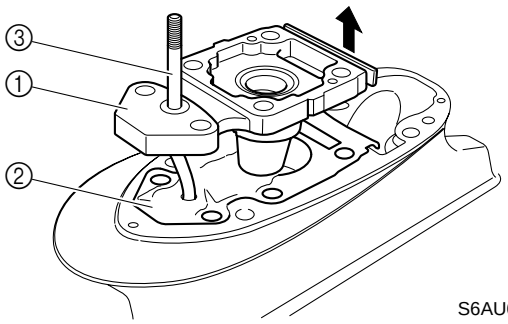
Removing the drive shaft, drive shaft housing, and shift rod

1. Remove the pinion nut.


S6AU6106

2. Remove the pinion, pinion shim(s), and roller bearing.

3. Remove the drive shaft, and then remove the drive shaft housing assembly ①, gasket ②, and shift rod ③.


S6AU6107

CAUTION:

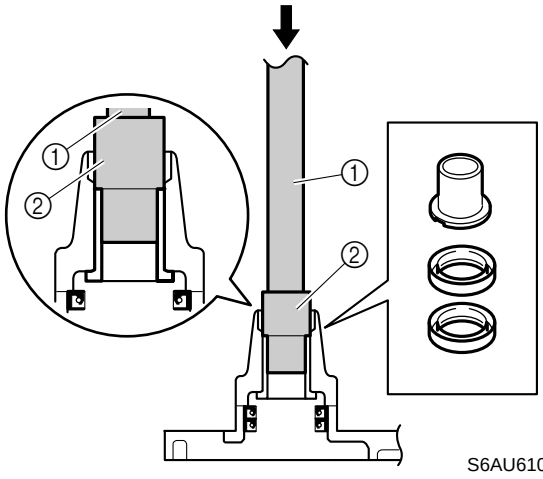
Be sure to remove the drive shaft before removing the drive shaft housing assembly from the lower case.

4. Remove the drive shaft sleeve.

5. Pull out the forward gear.

Disassembling the drive shaft housing

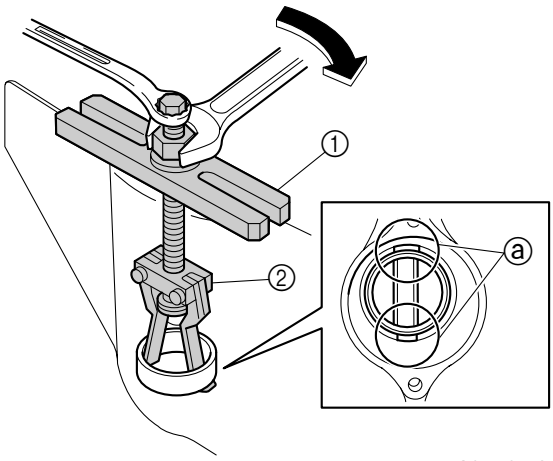
1. Remove the oil seals and bushing.


S6AU6109

Driver rod L3 ①: 90890-06652
Bushing attachment ②: 90890-06649

Disassembling the lower case

1. Remove the taper roller bearing outer race and forward gear shim(s).


S6AU6113

CAUTION:

Do not reuse the bearing, always replace it with a new one.

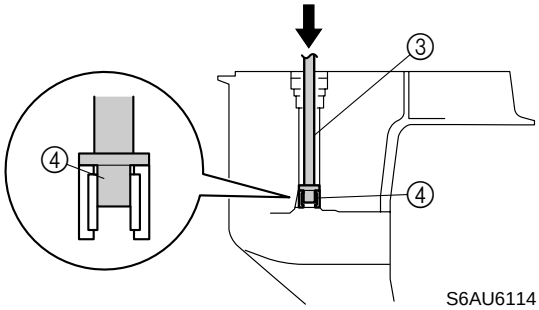
NOTE:

Fit the hooks of the puller claw into the slots ⓐ in the lower case.

Stopper guide plate ①: 90890-06501
Bearing puller assembly ②: 90890-06535

6

2. Remove the needle bearing from the lower case.



S6AU6114

CAUTION:

Do not reuse the bearing, always replace it with a new one.

Driver rod L3 ③: 90890-06652
Needle bearing attachment ④: 90890-06617

Checking the pinion and forward gear

1. Check the teeth of the pinion, and the teeth and dogs of the forward gear. Replace the pinion or forward gear if cracked or worn.

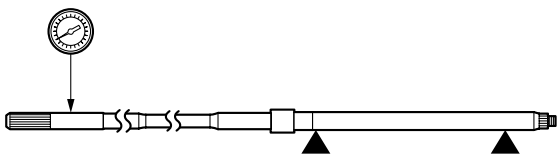
Checking the bearing

1. Check the bearings. Replace if pitted or if there is rumbling.

Checking the drive shaft

1. Check the drive shaft. Replace if bent or worn.

2. Measure the drive shaft runout. Replace if above specification.


S6AU6115

Drive shaft runout limit:
0.5 mm (0.0197 in)

Checking the shift rod

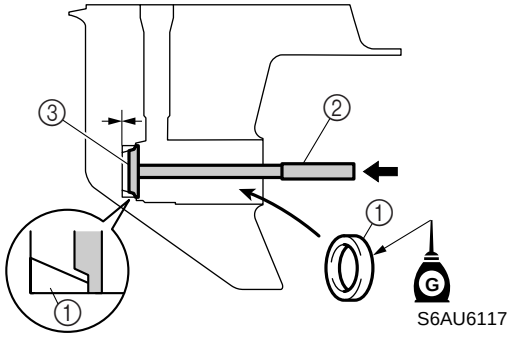
1. Check the shift rod. Replace if bent or worn.

Checking the lower case

1. Check the skeg, torpedo, and anti-cavitation plate. Replace the lower case if cracked or damaged.

Assembling the lower case

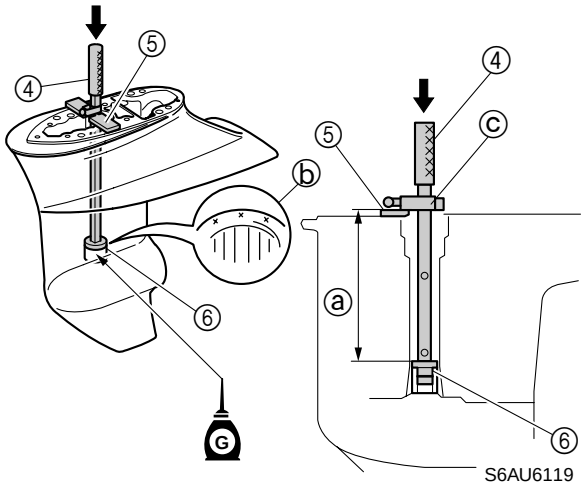
1. Install a new taper roller bearing outer race ①.



S6AU6117

Driver rod LL ②: 90890-06605
Bearing outer race attachment ③: 90890-06625

2. Install a new needle bearing into the lower case to the specified depth ⓐ.



S6AU6119

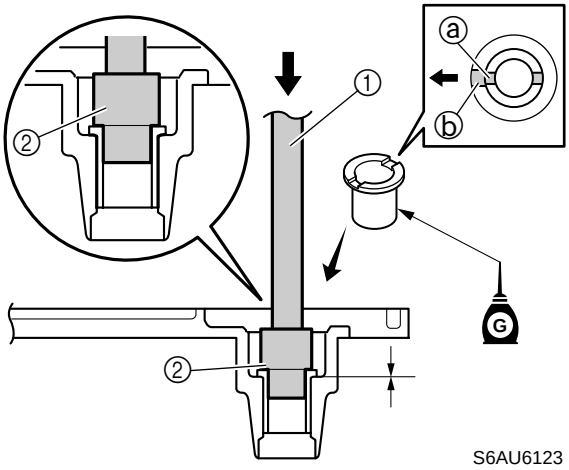
NOTE:
- Install the needle bearing with the manufacture identification mark ⓑ facing upward.
- Install the stopper ⓒ onto the driver rod SL at the installation depth ⓐ as shown. Install the needle bearing until the stopper ⓒ contacts the special service tool ⑤.

Driver rod SL ④: 90890-06602
Bearing depth plate ⑤: 90890-06603
Needle bearing attachment ⑥: 90890-06617

Installation depth ⓐ: 189.3–189.8 mm (7.45–7.47 in)

Assembling the drive shaft housing

1. Install the bushing into the drive shaft housing.

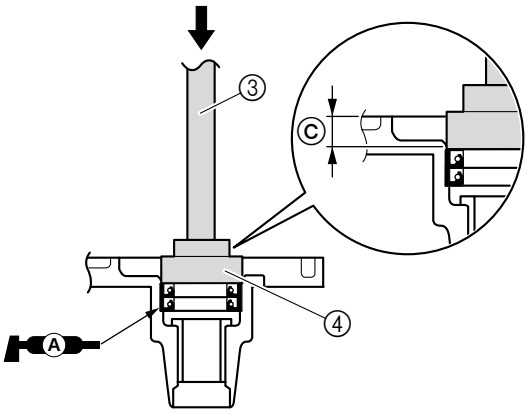


S6AU6123

NOTE:
Align a groove ⓐ in the bushing with the hole ⓑ in the drive shaft housing.

Driver rod L3 ①: 90890-06652
Bushing attachment ②: 90890-06649

2. Apply grease to new oil seals, and then install them into the drive shaft housing to the specified depth ⓒ.



S6AU6125

NOTE:
Install an oil seal halfway into the drive shaft housing, and then install the other oil seal.

Driver rod L3 ③: 90890-06652
Needle bearing attachment ④: 90890-06613

Installation depth ⓒ: 7.0–8.0 mm (0.28–0.31 in)

6

Installing the shift rod, drive shaft housing, and drive shaft

1. Install the forward gear assembly ① into the lower case.

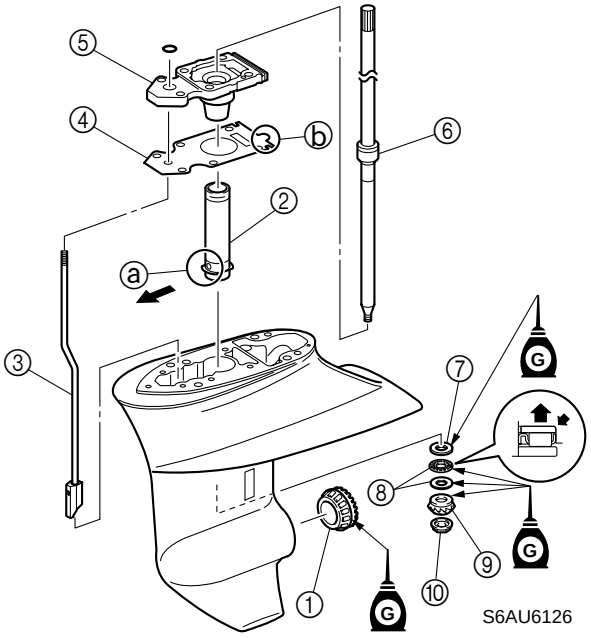
2. Install the drive shaft sleeve ② into the lower case.

NOTE:
Install the drive shaft sleeve ② with the hole ⓐ facing forward.

3. Install the shift rod ③, a new gasket ④, and the drive shaft housing assembly ⑤.

NOTE:
Make sure that the projection ⓑ on the gasket is toward the port side.

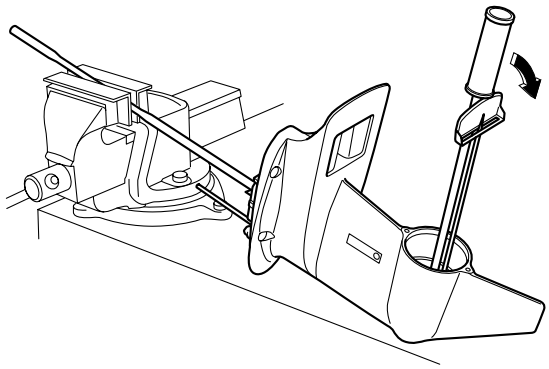
4. Install the drive shaft ⑥, original pinion shim(s) ⑦, roller bearing ⑧, pinion ⑨, and pinion nut ⑩ to the drive shaft.



S6AU6126

NOTE:
- When installing the pinion, lift up the drive shaft slightly and align the pinion and shaft splines.
- Be sure to select the pinion shim(s) if replacing the pinion, roller bearing, or lower case. To select the shim, see "Shimming (high thrust model)" (6-39).

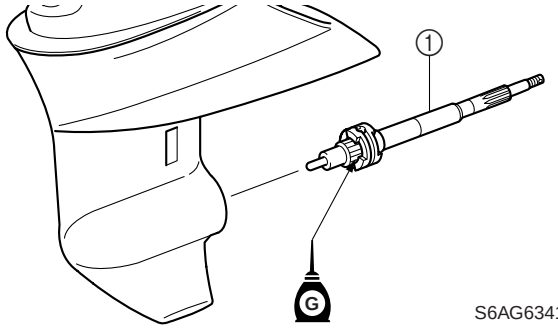
5. Tighten the pinion nut ⑩ to the specified torque.


S6AU6127

Pinion nut ⑩:
25 N·m (2.5 kgf·m, 18.4 ft·lb)

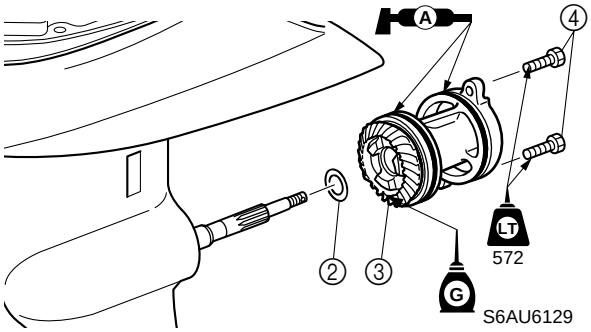
Installing the propeller shaft housing

1. Install the propeller shaft assembly ① into the lower case.



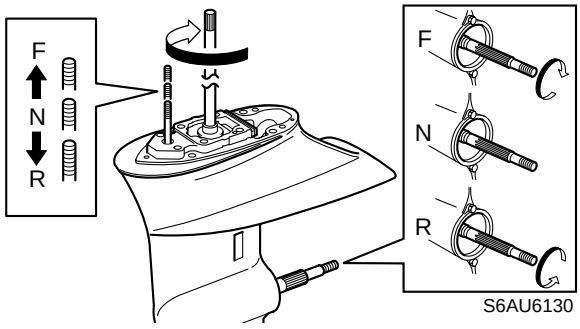
S6AG6341

2. Install the washer ② and propeller shaft housing assembly ③ into the lower case, and then tighten the bolts ④ to the specified torque.



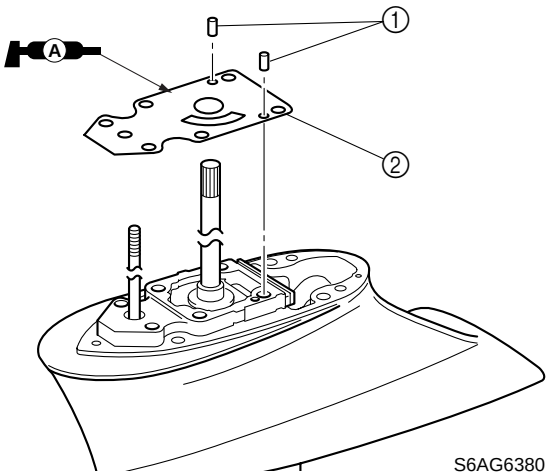
Propeller shaft housing bolt ④:
8 N·m (0.8 kgf·m, 5.9 ft·lb)

3. Check that the shifting mechanism works properly and smoothly.

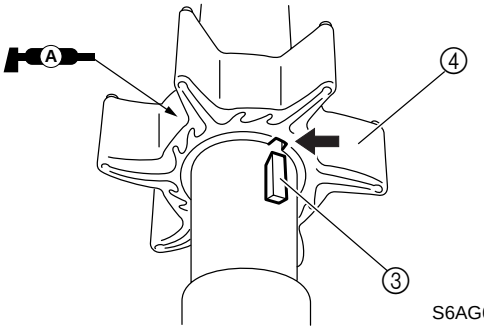


Installing the water pump

1. Install the dowels ① and outer plate cartridge ②.

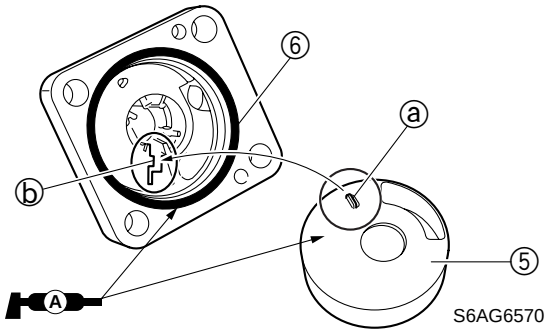


2. Install the Woodruff key ③ and impeller ④ to the drive shaft.



NOTE:
When installing the impeller ④ onto the drive shaft, align the groove in the impeller with the Woodruff key ③.

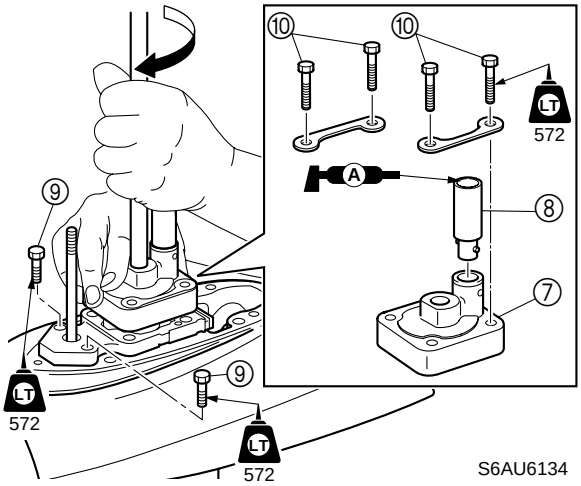
3. Install the insert cartridge ⑤ and a new O-ring ⑥ into the water pump housing.



NOTE:
Align the insert cartridge projection ⓐ with the hole ⓑ in the water pump housing.

6

4. Install the water pump housing assembly ⑦ into the lower case, and then install the rubber seal ⑧.



CAUTION:

Do not turn the drive shaft counterclockwise, otherwise the water pump impeller may be damaged.

NOTE:

- Apply grease to the inside of the water pump housing.
- While turning the drive shaft clockwise, push down on the water pump housing and install it.
- Align the projections on the rubber seal ⑧ with the holes in the water pump housing.

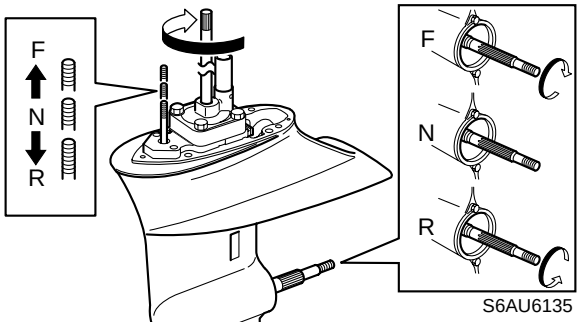
5. Tighten the water pump housing bolts ⑨ and ⑩ to the specified torque.

Water pump housing bolt ⑨ and ⑩:
18 N·m (1.8 kgf·m, 13.3 ft·lb)

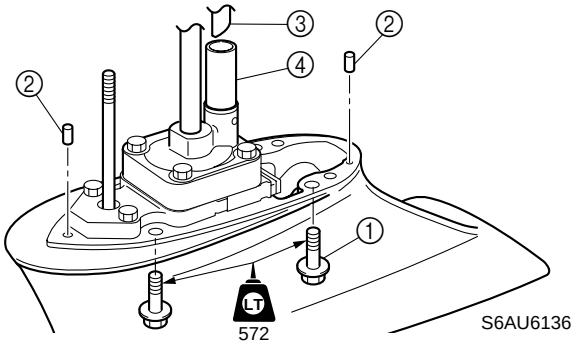
Installing the lower unit

1. Set the shift lever to the R position. (H model)
   Set the remote control lever to the R position. (R model)

2. Set the shift rod to the R position.



3. Install the lower unit to the upper case, and then tighten the lower case mounting bolts ① to the specified torque.

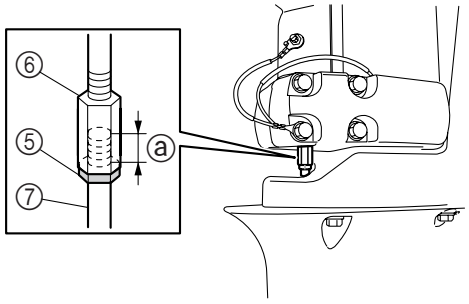


NOTE:

- Before installing the lower unit to the upper case, install the dowels ② into the lower case.
- Before installing the lower unit, make sure that the locknut is removed from the shift rod.
- When installing the lower unit, make sure that the water pipe ③ is inserted securely into the rubber seal ④.

Lower case mounting bolt ①:
18 N·m (1.8 kgf·m, 13.3 ft·lb)

4. Install the locknut ⑤, and then screw the adjusting nut ⑥ onto the shift rod ⑦.



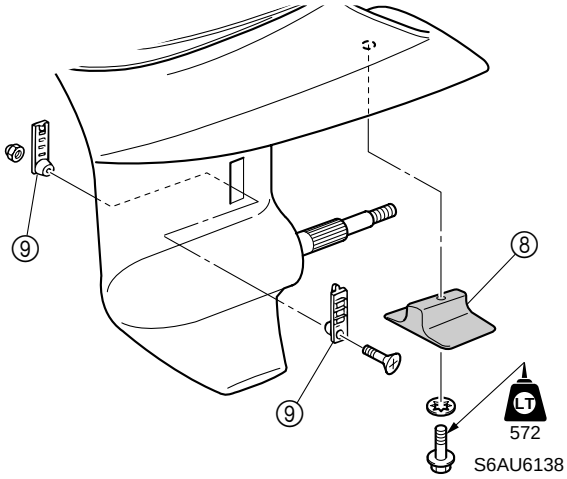
S6AU6059

Screwed-in length ⓐ:
8.0–9.0 mm (0.31–0.35 in)

5. Tighten the locknut ⑤.

NOTE:
After connecting the shift rod, check that the gear shift operates properly.

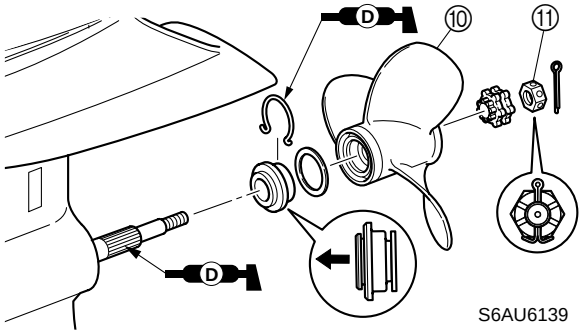
6. Install the anode ⑧ and cooling water inlet covers ⑨, and then tighten the anode bolt to the specified torque.



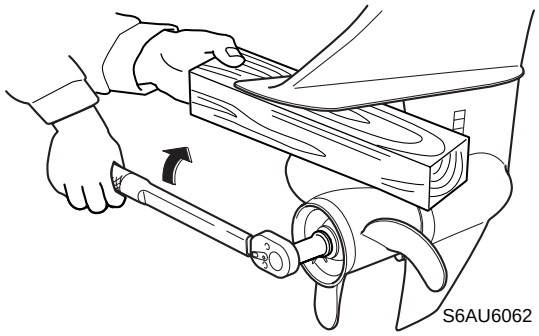
S6AU6138

Anode bolt:
8 N·m (0.8 kgf·m, 5.9 ft·lb)

7. Install the propeller ⑩ and propeller nut ⑪. Place a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning, and then tighten the nut to the specified torque.



S6AU6139


S6AU6062

⚠ WARNING

- **Do not hold the propeller with your hands when loosening or tightening it.**
- **Be sure to disconnect the battery cables from the battery and remove the clip from the engine shut-off switch. (E model)**

NOTE:
If the holes in the propeller nut do not align with the cotter pin hole, tighten the nut until they are aligned.

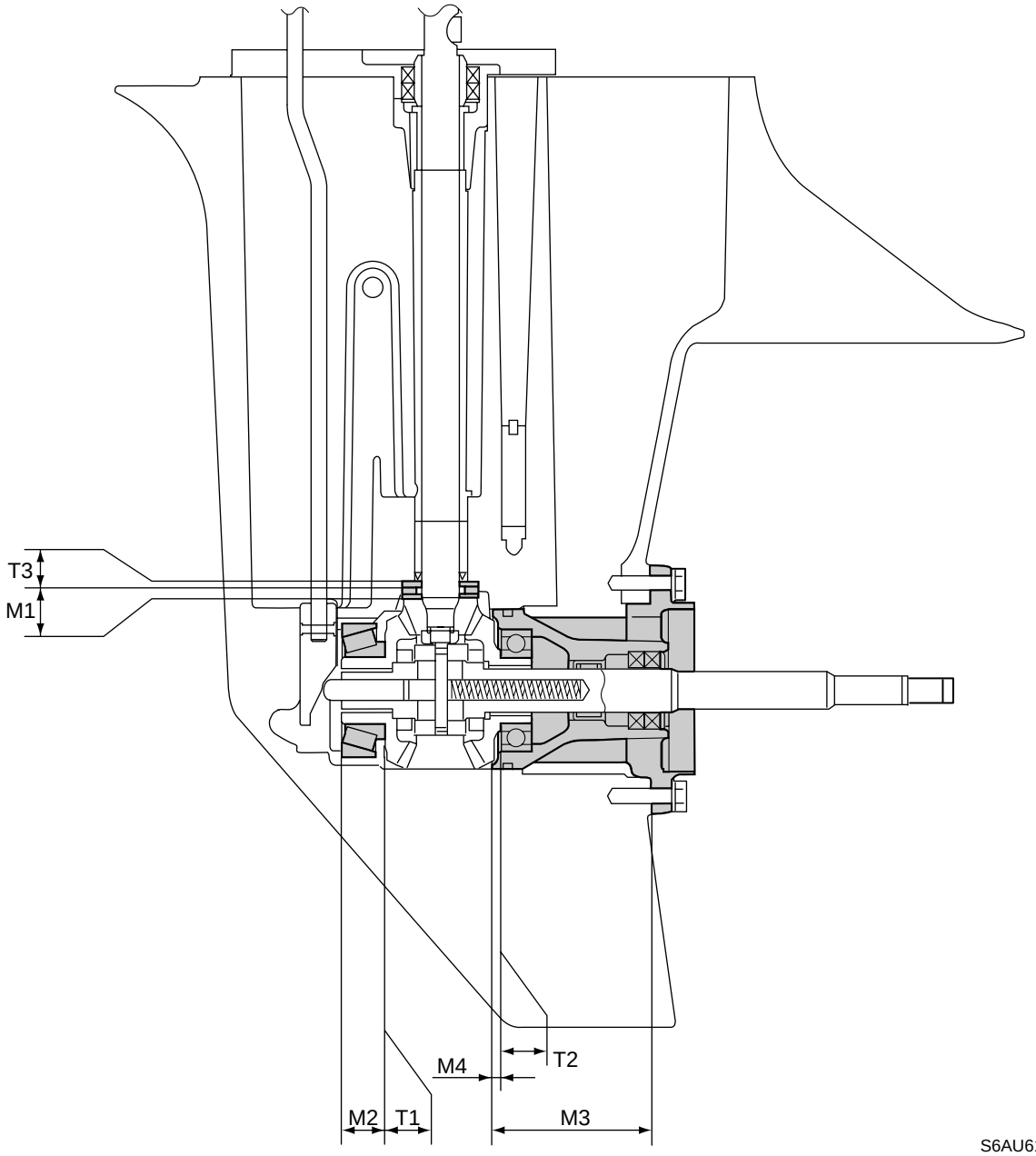
Propeller nut:
21 N·m (2.1 kgf·m, 15.5 ft·lb)

8. Fill the lower unit with gear oil to the correct level.

Recommended gear oil:
Hypoid gear oil
API: GL-4
SAE: 90
Gear oil quantity:
370 cm^3
(12.51 US oz, 13.05 Imp oz)

6

Shimming (high thrust model)

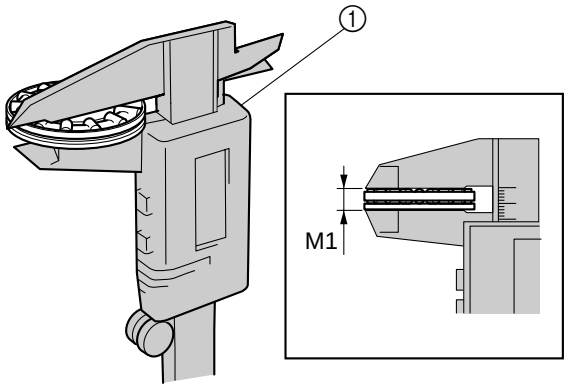


Shimming

NOTE:
- Shimming is not required when assembling the original lower case and inner parts.
- Shimming is required when assembling the original inner parts and a new lower case.
- Shimming is required when replacing the inner part(s).

Selecting the pinion shim

1. Measure the thickness (M1) of the roller bearing.



S6AU6142

NOTE:
- Select the shim thickness (T3) by using the specified measurement(s) and the calculation formula.
- Measure the roller bearing at 4 points to find the thickness average.

Digital caliper ①: 90890-06704

2. Calculate the pinion shim thickness.

Calculation formula:
Pinion shim thickness (T3) =
6.05 – M1

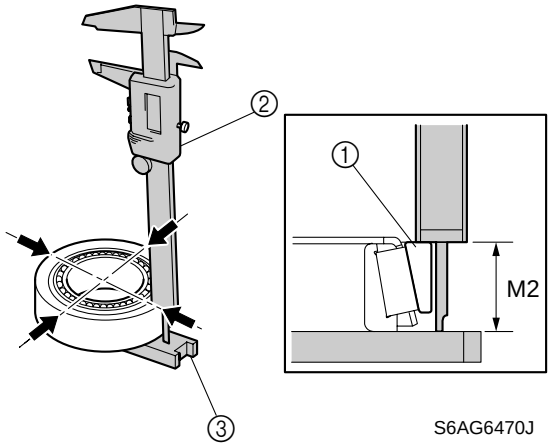
3. Select the pinion shim(s) (T3) as follows.

Calculated number	Shim thickness (mm)
1.14–1.20	1.13
1.21–1.30	1.20

Available shim thicknesses:
1.13 and 1.20 mm

Selecting the forward gear shim

1. Turn the taper roller bearing outer race ① 2 or 3 times to seat the rollers, and then measure the bearing height (M2) as shown.



S6AG6470J

NOTE:
- Select the shim thickness (T1) by using the specified measurement(s) and the calculation formula.
- Measure the bearing outer race at 4 points to find the height average.

Digital caliper ②: 90890-06704
Shimming plate ③: 90890-06701

2. Calculate the forward gear shim thickness.

Calculation formula:
Forward gear shim thickness (T1) =
16.50 – M2

6

3. Select the forward gear shim(s) (T1) as follows.

Calculated number	Shim thickness (mm)
0.00–0.10	—
0.11–0.20	0.10
0.21–0.30	0.20
0.31–0.40	0.30
0.41–0.50	0.40

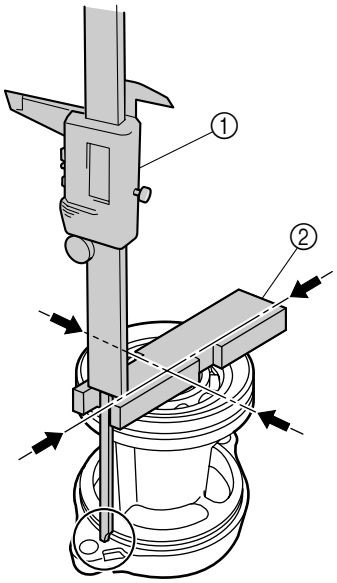
Available shim thicknesses:
0.10, 0.20, 0.30, and 0.40 mm

Example:
If “T1” is 0.23 mm, then the forward gear shim thickness is 0.20 mm.
If “T1” is 0.30 mm, then the forward gear shim thickness is 0.20 mm.

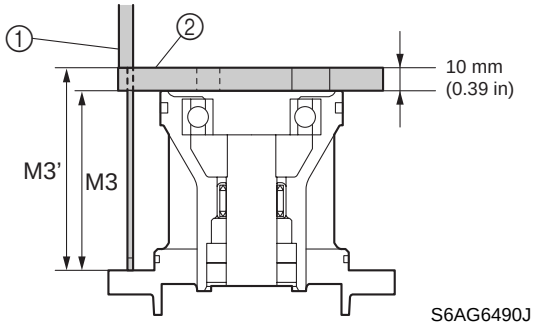
Selecting the reverse gear shim

1. Remove the reverse gear and reverse gear shim(s) from the propeller shaft housing.

2. Measure the propeller shaft housing height (M3) as shown.



S6AG6480



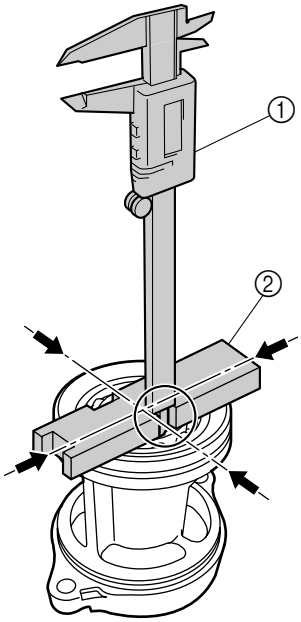
S6AG6490J

M3 = M3' – 10 mm

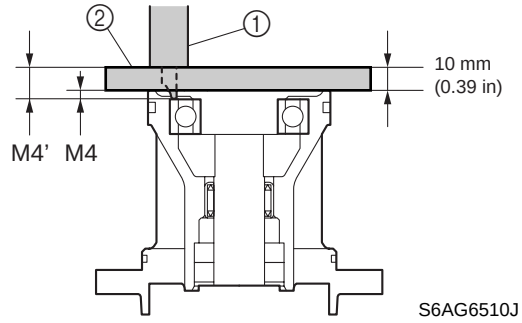
NOTE:
Measure the propeller shaft housing at 4 points to find the height average.

Digital caliper ①: 90890-06704
Shimming plate ②: 90890-06701

3. Turn the ball bearing 2 or 3 times, and then measure the height from the ball bearing (M4) as shown.



S6AG6500



M4 = M4' – 10 mm

NOTE:
- Select the shim thickness (T2) by using the specified measurement(s) and the calculation formula.
- Measure the height from the ball bearing at 4 points to find the height average.

4. Calculate the reverse gear shim thickness.

Calculate formula:
Reverse gear shim thickness (T2) = 58.05 – (M3 – M4)

5. Select the reverse gear shim(s) (T2) as follows.

Calculated number	Shim thickness (mm)
0.00–0.10	—
0.11–0.20	0.1
0.21–0.30	0.2
0.31–0.32	0.3

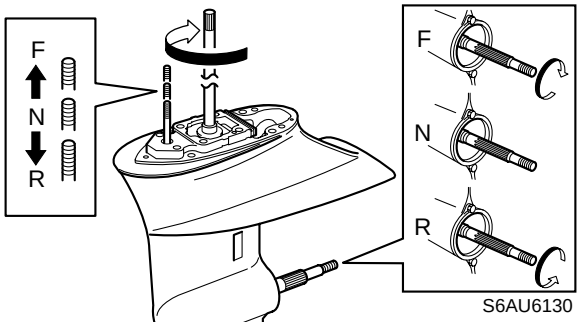
Available shim thicknesses:
0.1, 0.2, and 0.3 mm

Backlash (high thrust model)

Measuring the forward and reverse gear backlash

NOTE:
- Remove the water pump assembly before measuring the backlash.
- Secure the drive shaft housing to the lower case using 6 bolts (M8 × 25 mm).

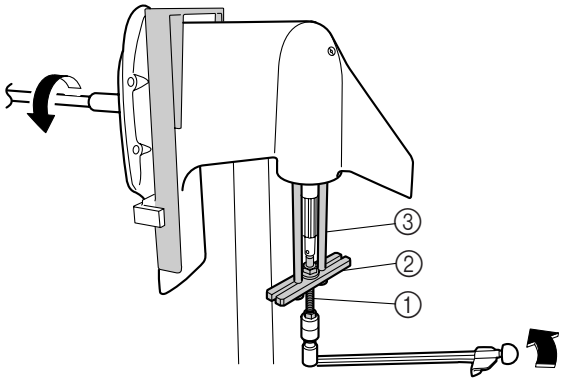
1. Install the lower unit onto a repair stand.
2. Set the shift rod to the N position at the lower unit.



3. Turn the lower unit so that the propeller shaft is facing down.
4. Install the special service tools.

6

5. Tighten the center bolt ① to the specified torque while turning the drive shaft.



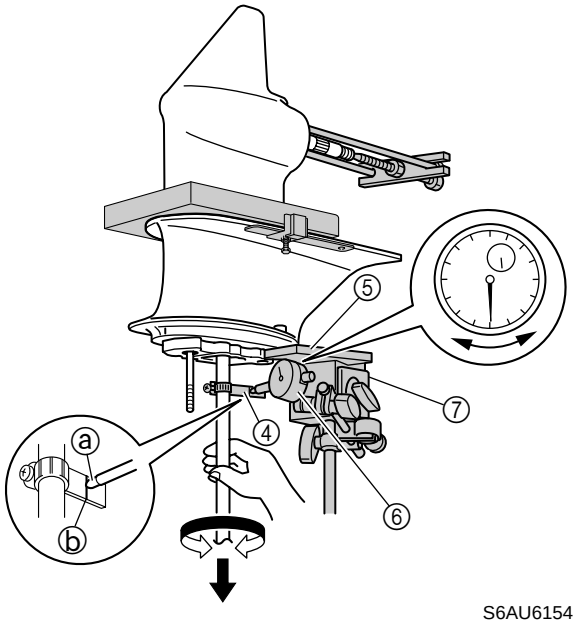
S6AU6152

Center bolt ①: 90890-06504
Stopper guide plate ②: 90890-06501
Bearing housing puller claw S ③: 90890-06564

Center bolt ①:
2 N·m (0.2 kgf·m, 1.5 ft·lb)

6. Turn the lower unit upside down.

7. Install the backlash indicator onto the drive shaft (12.8 mm [0.50 in] in diameter), and then install the dial gauge.



S6AU6154

NOTE:
Install the dial gauge so that the plunger tip ⓐ is aligned with the mark ⓑ on the backlash indicator.

Backlash indicator ④: 90890-06706
Magnet base plate ⑤: 90890-07003
Dial gauge set ⑥: 90890-01252
Magnet base B ⑦: 90890-06844

8. Slowly turn the drive shaft clockwise and counterclockwise and measure the backlash when the drive shaft stops in each direction.

NOTE:
- Pull the drive shaft downward, and then turn it.
- Measure the backlash at 4 points to find the average.

Forward gear backlash:
0.76–2.30 mm (0.0299–0.0906 in)

9. Adjust the current shim thickness if the forward gear backlash is out of specification.

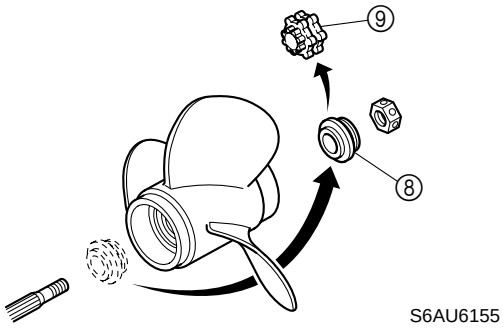
Forward gear backlash	Shim thickness
Less than 0.76 mm (0.0299 in)	To be decreased by (1.53 – M) × 0.39
More than 2.30 mm (0.0906 in)	To be increased by (M – 1.53) × 0.39

M: Measurement

Available shim thicknesses:
0.10, 0.20, 0.30, and 0.40 mm

10. Remove the special service tools from the propeller shaft.

11. Install the propeller, spacer ⑧, and nut, without installing the spacer ⑨.

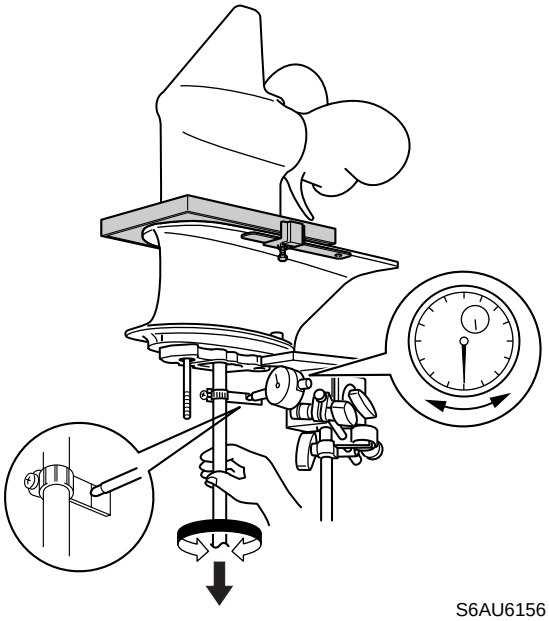


S6AU6155

12. Tighten the propeller nut to the specified torque.

Propeller nut:
2 N·m (0.2 kgf·m, 1.5 ft·lb)

13. Slowly turn the drive shaft clockwise and counterclockwise and measure the backlash when the drive shaft stops in each direction.


S6AU6156

NOTE:
- Pull the drive shaft downward, and then turn it.
- Measure the backlash at 4 points to find the average.

Reverse gear backlash:
0.76–2.30 mm (0.0299–0.0906 in)

14. Adjust the current shim thickness if the reverse gear backlash is out of specification.

Reverse gear backlash	Shim thickness
Less than 0.76 mm (0.0299 in)	To be decreased by (1.53 – M) × 0.39
More than 2.30 mm (0.0906 in)	To be increased by (M – 1.53) × 0.39

M: Measurement

Available shim thicknesses:
0.1, 0.2, and 0.3 mm

15. Turn the lower unit upright.

16. Remove the special service tools and propeller, and then install the water pump assembly.

NOTE:
To install the water pump assembly, see "Installing the water pump" (6-36).

17. Fill the lower unit with gear oil to the correct level.

6

Bracket unit

Tiller handle (short) 7-1
Removing the tiller handle 7-3
Installing the tiller handle 7-3

Tiller handle (long) 7-5
Removing the tiller handle 7-8
Installing the tiller handle 7-8

Friction plate (H model) 7-11
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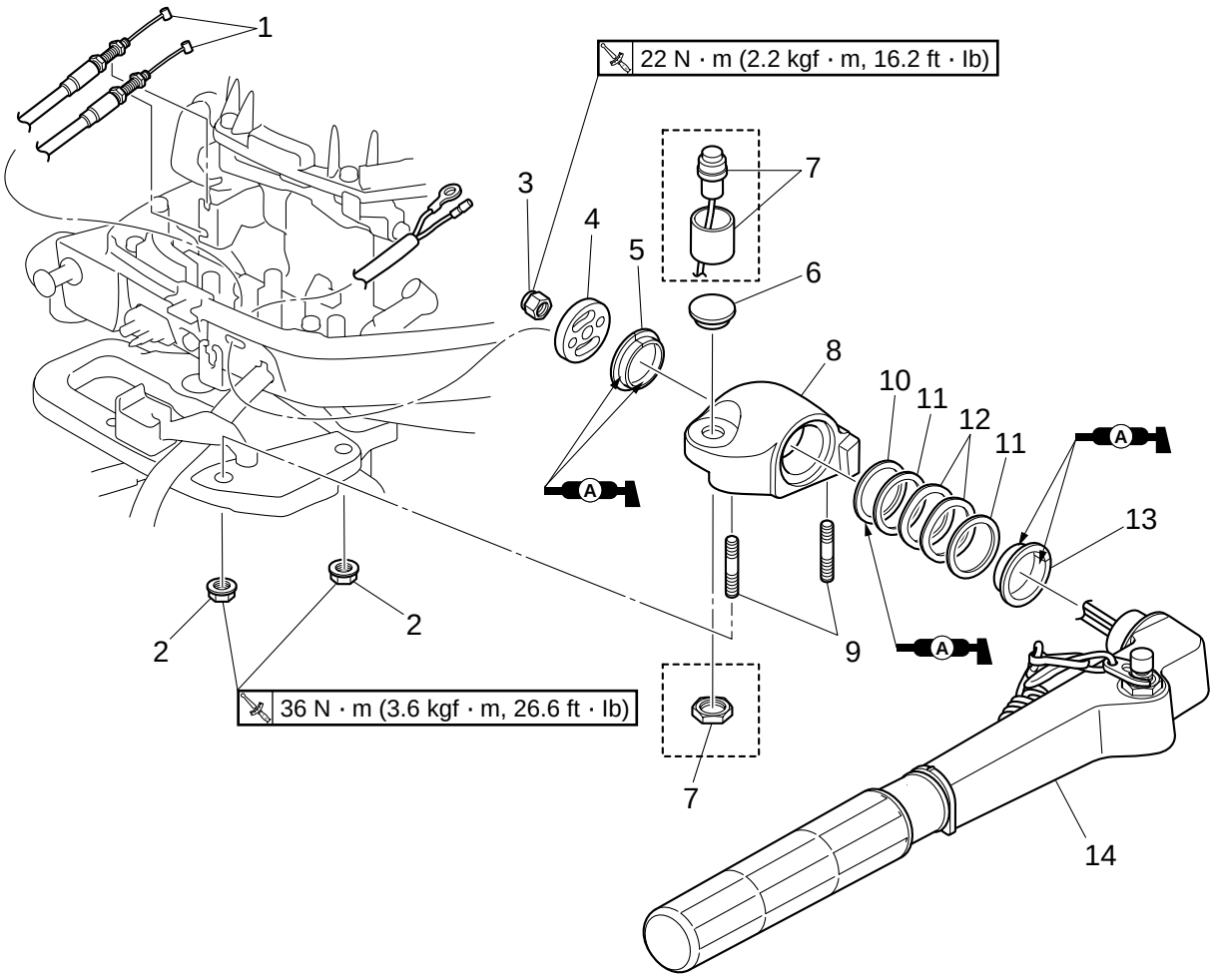
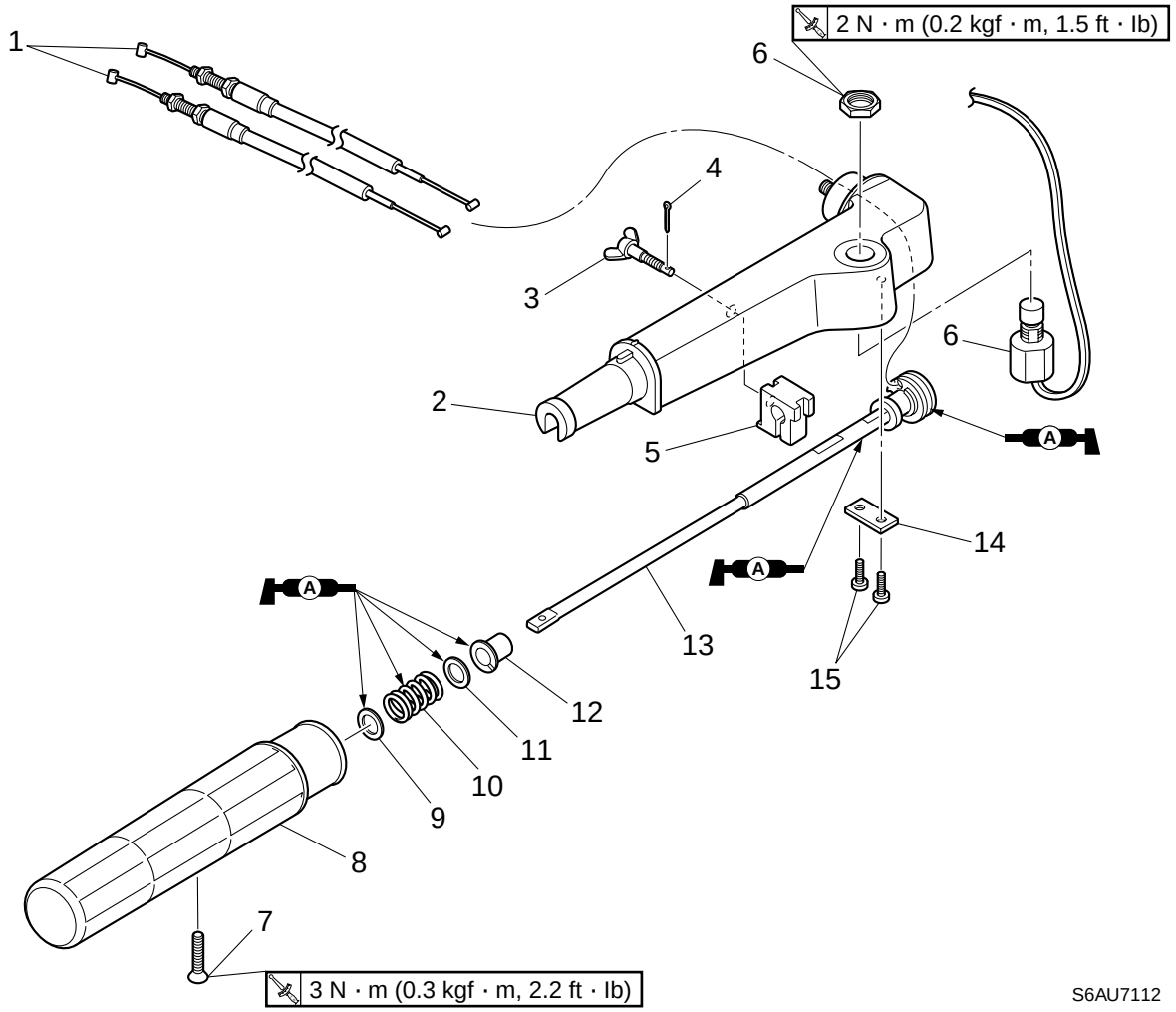
Tiller handle (short)



S6AU7111

No.	Part name	Q'ty	Remarks
1	Throttle cable	2	
2	Nut	2	
3	Nut	1	
4	Plate	1	
5	Bushing	1	
6	Plug	1	M model
7	Engine start button	1	E model
8	Tiller handle bracket	1	
9	Stud bolt	2	
10	Bushing	1	
11	Washer	2	
12	Wave washer	2	
13	Bushing	1	
14	Tiller handle assembly	1	



No.	Part name	Q'ty	Remarks
1	Throttle cable	2	
2	Tiller handle	1	
3	Throttle friction adjuster	1	
4	Cotter pin	1	
5	Friction piece	1	
6	Engine shut-off switch	1	
7	Screw	1	ø5 × 20 mm
8	Grip	1	
9	Washer	1	
10	Spring	1	
11	Washer	1	
12	Bushing	1	
13	Throttle shaft	1	
14	Plate	1	
15	Screw	2	ø5 × 11 mm

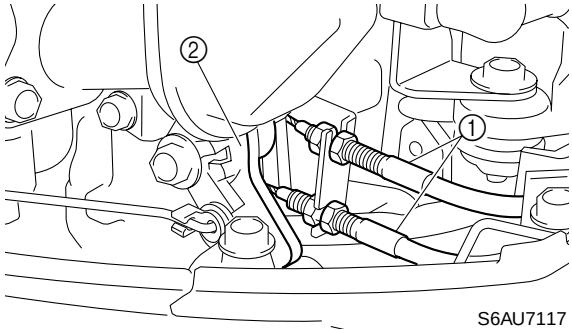
7

Removing the tiller handle

1. Disconnect the engine shut-off switch leads and engine start button leads (E model).

NOTE:
To disconnect the leads, see “Electrical component and wiring harness routing” (8-1).

2. Disconnect the throttle cables ① from the throttle cam ②.



S6AU7117

3. Remove the tiller handle.

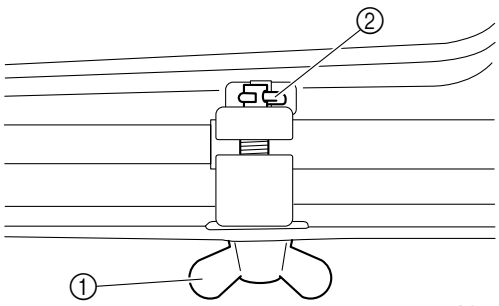
NOTE:
See the exploded diagram for disassembly (7-2).

Installing the tiller handle

1. Assemble the tiller handle.

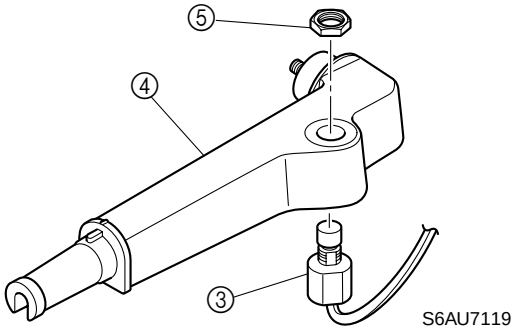
NOTE:
See the exploded diagram for assembly (7-2).

2. Install the throttle friction adjuster ①, and then install the cotter pin ②.

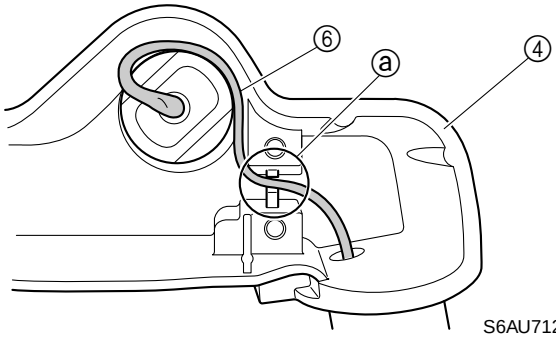


S6AU7118

3. Install the engine shut-off switch ③ to the tiller handle ④, and then tighten the nut ⑤ to the specified torque. Pass the engine shut-off switch lead through a hole in the pivot section of the tiller handle.



S6AU7119

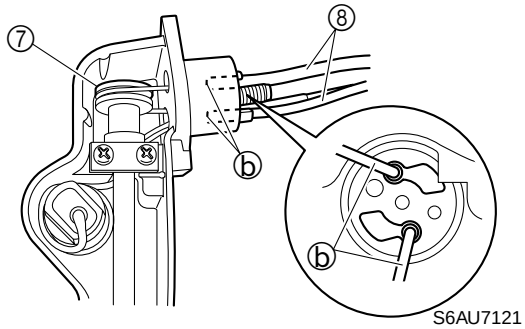


S6AU7120

NOTE:
Route the engine shut-off switch lead ⑥ as shown, making sure to fit it securely into the notch ⓐ in the tiller handle ④.

Engine shut-off switch nut ⑤:
2 N·m (0.2 kgf·m, 1.5 ft·lb)

4. Connect the throttle cable ends to the throttle pulley ⑦.



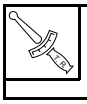
S6AU7121

NOTE:
Make sure that the ends ⓑ of the outer throttle cables ⑧ are fitted securely into the holes in the pivot section of the tiller handle as shown.

5. Install the tiller handle assembly to the tiller handle bracket, and then tighten the nut to the specified torque.

Tiller handle assembly nut:
22 N·m (2.2 kgf·m, 16.2 ft·lb)

6. Install the tiller handle assembly to the steering bracket, and then tighten the nuts to the specified torque.



Tiller handle bracket nut:
36 N·m (3.6 kgf·m, 26.6 ft·lb)

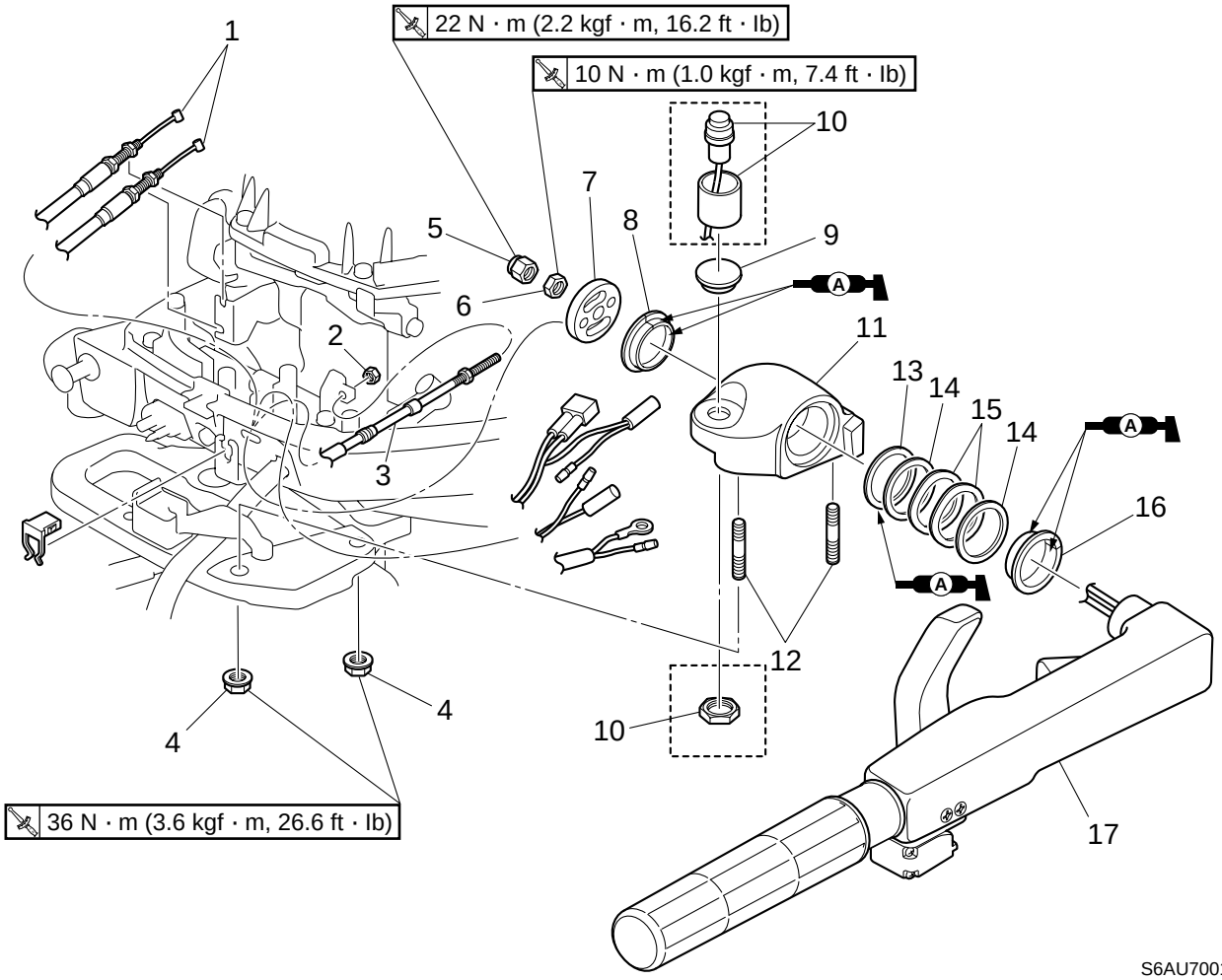
7. Connect the throttle cables to the throttle cam.

NOTE:
- To adjust the throttle cables, see “Adjusting the throttle cable (H model)” (3-7).
- When adjusting the throttle cables, make sure that the ends ⓑ of the outer cables are not pulled out of the holes in the pivot section of the tiller handle.

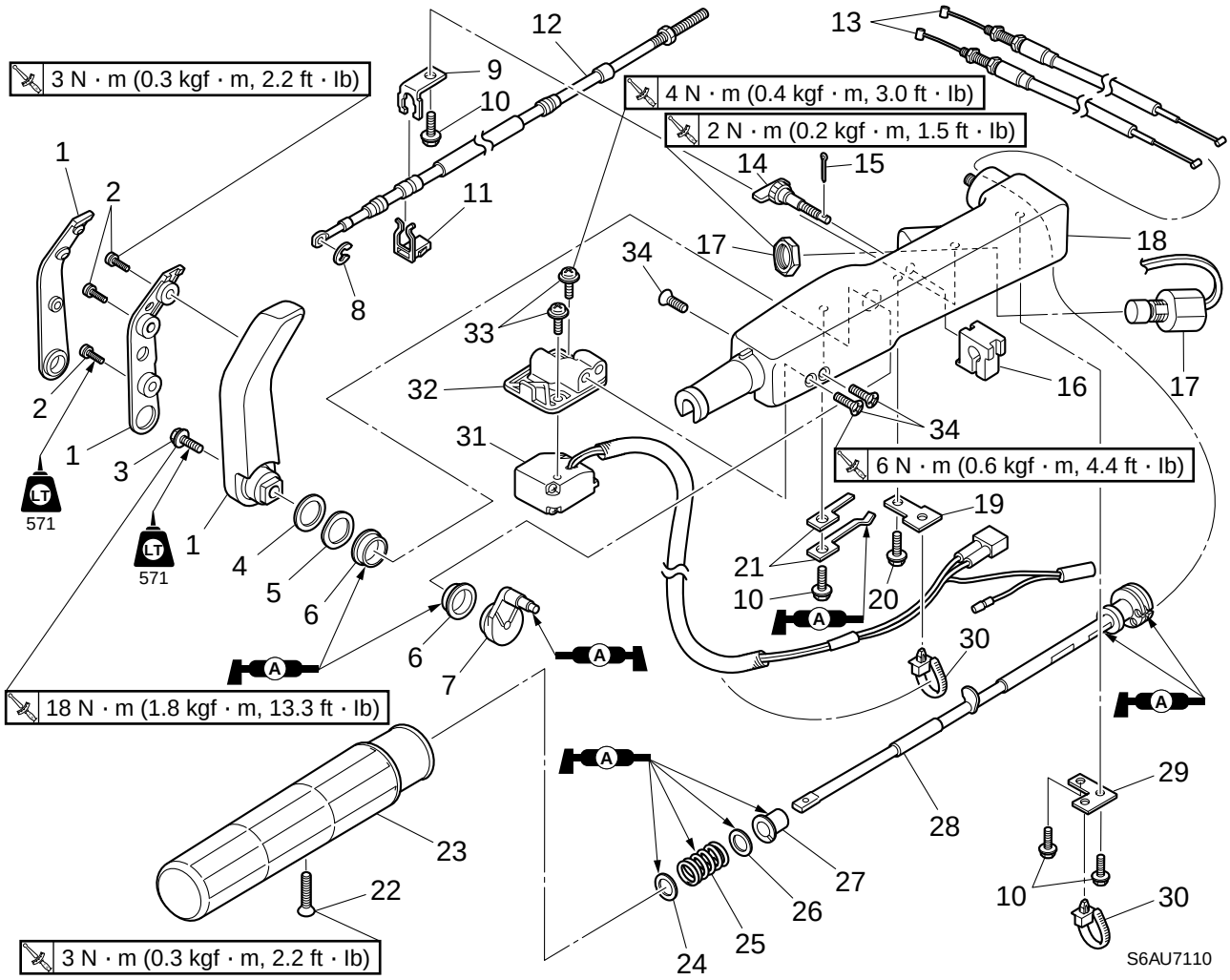
8. Connect the engine shut-off switch leads and engine start button lead (E model).

7

Tiller handle (long)

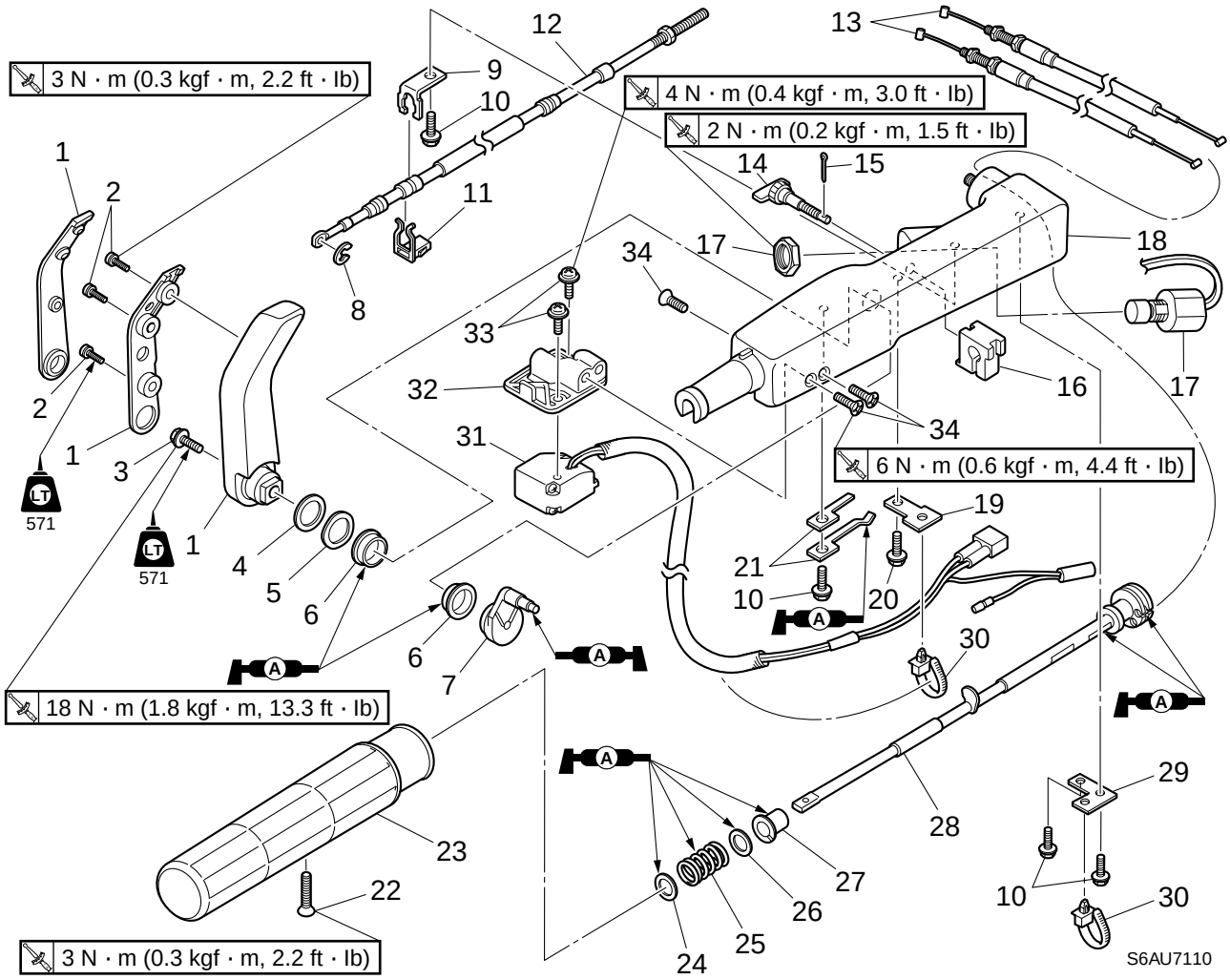


No.	Part name	Q'ty	Remarks
1	Throttle cable	2	
2	Nut	1	
3	Shift cable	1	
4	Nut	2	
5	Self-locking nut	1	
6	Nut	1	
7	Plate	1	
8	Bushing	1	
9	Plug	1	M model
10	Engine start button	1	E model
11	Tiller handle bracket	1	
12	Stud bolt	2	
13	Bushing	1	
14	Washer	2	
15	Wave washer	2	
16	Bushing	1	
17	Tiller handle assembly	1	


3 N · m (0.3 kgf · m, 2.2 ft · lb)
4 N · m (0.4 kgf · m, 3.0 ft · lb)
2 N · m (0.2 kgf · m, 1.5 ft · lb)
6 N · m (0.6 kgf · m, 4.4 ft · lb)
18 N · m (1.8 kgf · m, 13.3 ft · lb)
3 N · m (0.3 kgf · m, 2.2 ft · lb)
LT
571
A
S6AU7110

No.	Part name	Q'ty	Remarks
1	Shift lever	1	
2	Screw	3	ø6 × 10 mm
3	Bolt	1	M8 × 30 mm
4	Washer	1	
5	Wave washer	1	
6	Bushing	2	
7	Shift lever cam	1	
8	E-clip	1	
9	Holder	1	
10	Bolt	4	M6 × 16 mm
11	Holder	1	
12	Shift cable	1	
13	Throttle cable	2	
14	Throttle friction adjuster	1	
15	Cotter pin	1	
16	Friction piece	1	
17	Engine shut-off switch	1	

7


3 N · m (0.3 kgf · m, 2.2 ft · lb)
4 N · m (0.4 kgf · m, 3.0 ft · lb)
2 N · m (0.2 kgf · m, 1.5 ft · lb)
6 N · m (0.6 kgf · m, 4.4 ft · lb)
18 N · m (1.8 kgf · m, 13.3 ft · lb)
3 N · m (0.3 kgf · m, 2.2 ft · lb)
LT
571
A
S6AU7110

No.	Part name	Q'ty	Remarks
18	Tiller handle	1	
19	Plate	1	
20	Bolt	1	M6 × 20 mm
21	Spring	2	
22	Screw	1	ø5 × 20 mm
23	Grip	1	
24	Washer	1	
25	Spring	1	
26	Washer	1	
27	Bushing	1	
28	Throttle shaft	1	
29	Plate	1	
30	Plastic tie	2	
31	PT switch	1	PT model
32	Bracket	1	PT model
33	Screw	2	ø6 × 16 mm/PT model
34	Screw	3	ø6 × 16 mm/PT model

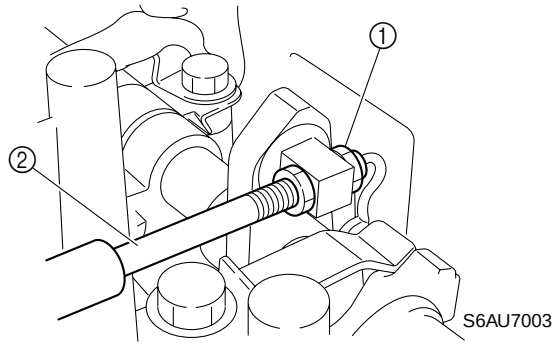
Removing the tiller handle

1. Disconnect the engine shut-off switch leads, engine start button leads (E model), and PT switch leads (PT model).

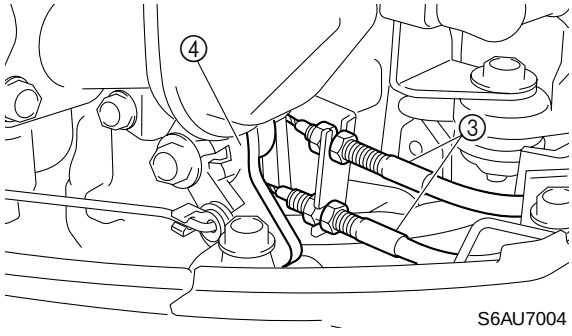
2. Remove the manual starter. (M model) Remove the PT relay, PT relay bracket (PT model), starter relay, and starter relay bracket. (E model)

NOTE:
To remove the parts, see “Electrical component and wiring harness routing” (8-1).

3. Remove the nut ① and disconnect the shift cable ②.



4. Disconnect the throttle cables ③ from the throttle cam ④.



5. Remove the tiller handle.

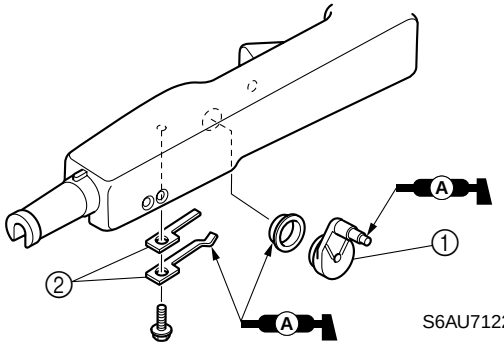
NOTE:
See the exploded diagram for disassembly (7-6).

Installing the tiller handle

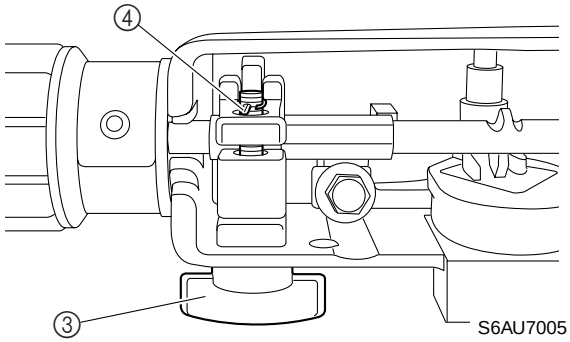
1. Assemble the tiller handle.

NOTE:
See the exploded diagram for assembly (7-6).

2. Install the shift lever cam ① and cam springs ②.



3. Install the throttle friction adjuster ③, and then install the cotter pin ④.

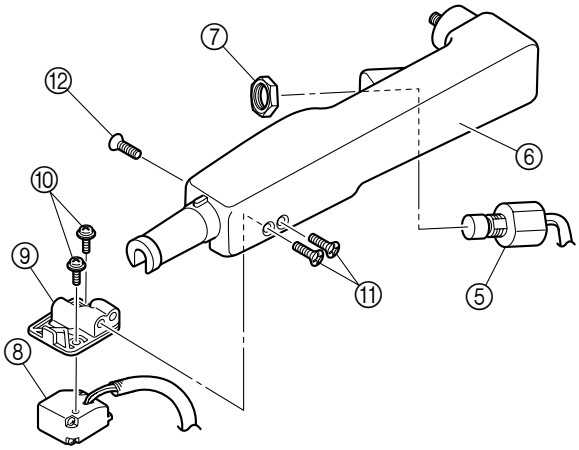


7

4. Install the engine shut-off switch ⑤ to the tiller handle ⑥, and then tighten the nut ⑦ to the specified torque. Pass the engine shut-off switch lead through a hole in the pivot section of the tiller handle.

5. Install the PT switch ⑧ to the bracket ⑨, and then tighten the bracket screws ⑩ to the specified torque. (PT model)

6. Install the PT switch ⑧ to the tiller handle ⑥, and then tighten the PT switch screws ⑪ and ⑫ to the specified torque. (PT model)

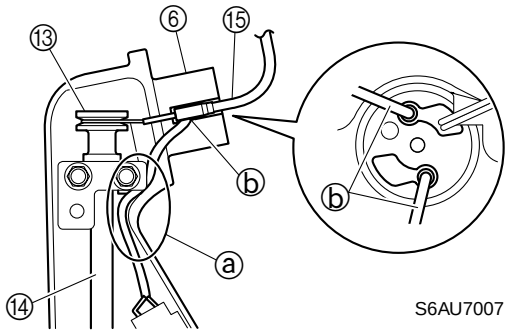


S6AU7006

NOTE:
Tighten the screws ⑪, and then tighten the screw ⑫.

Engine shut-off switch nut ⑦:
2 N·m (0.2 kgf·m, 1.5 ft·lb)
PT switch bracket screw ⑩:
4 N·m (0.4 kgf·m, 3.0 ft·lb)
PT switch screw ⑪ and ⑫:
6 N·m (0.6 kgf·m, 4.4 ft·lb)

7. Connect the throttle cable ends to the throttle pulley ⑬.



S6AU7007

NOTE:
- When routing the engine shut-off switch lead, make sure that it does not contact the throttle shaft ⑭ in the area ⓐ.
- Make sure that the ends ⓑ of the outer throttle cables ⑮ are fitted securely into the holes in the pivot section of the tiller handle as shown.

8. Install the tiller handle assembly to the tiller handle bracket, and then tighten the nuts to the specified torque.

Tiller handle assembly nut:
10 N·m (1.0 kgf·m, 7.4 ft·lb)
Tiller handle assembly self-locking nut: 22 N·m (2.2 kgf·m, 16.2 ft·lb)

9. Install the tiller handle assembly to the steering bracket, and then tighten the nuts to the specified torque.

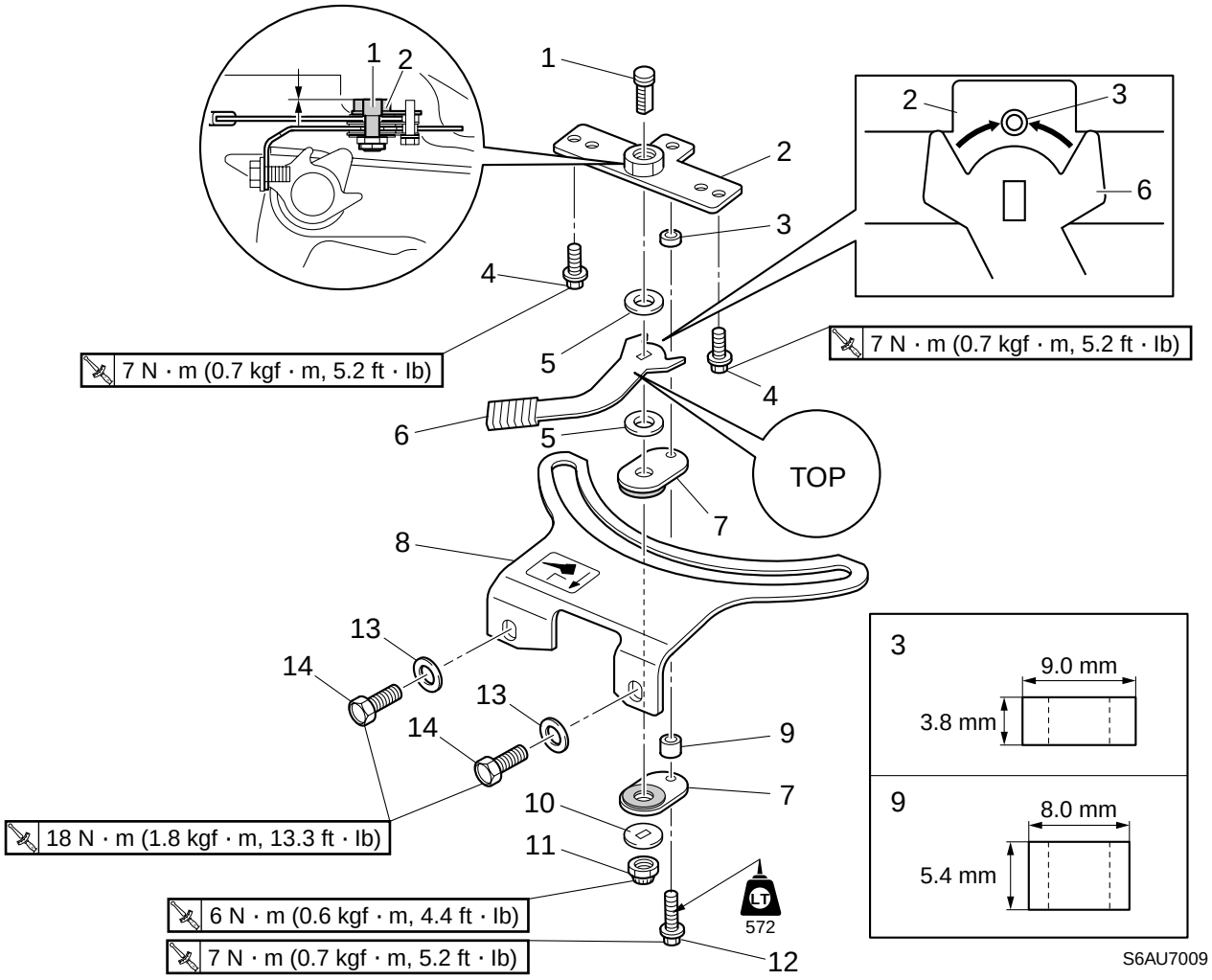
Tiller handle bracket nut:
36 N·m (3.6 kgf·m, 26.6 ft·lb)

10. Connect the throttle cables to the throttle cam.

NOTE:
- To adjust the throttle cables, see “Adjusting the throttle cable (H model)” (3-7).
- When adjusting the throttle cables, make sure that the ends ⓑ of the outer cables are not pulled out of the holes in the pivot section of the tiller handle.

11. Connect the engine shut-off switch leads, engine start button leads (E model), and PT switch leads (PT model).

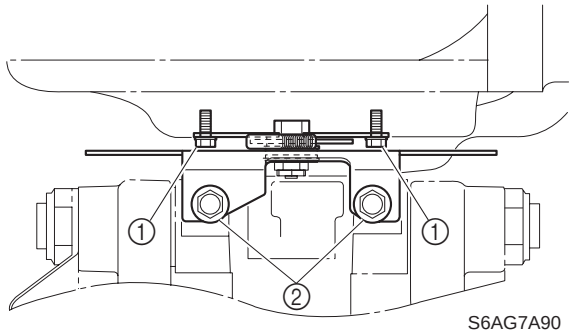
Friction plate (H model)



No.	Part name	Q'ty	Remarks
1	Steering lock shaft	1	
2	Bracket	1	
3	Collar	1	Short
4	Bolt	2	M5 × 14 mm
5	Washer	2	
6	Steering lock lever	1	
7	Friction piece	2	
8	Friction plate	1	
9	Collar	1	Long
10	Steering lock washer	1	
11	Self-locking nut	1	
12	Bolt	1	M5 × 20 mm
13	Washer	2	
14	Bolt	2	M8 × 16 mm

Disassembling the friction plate

1. Remove the friction plate bolts ① and ②, and then remove the friction plate assembly from the swivel bracket.



S6AG7A90

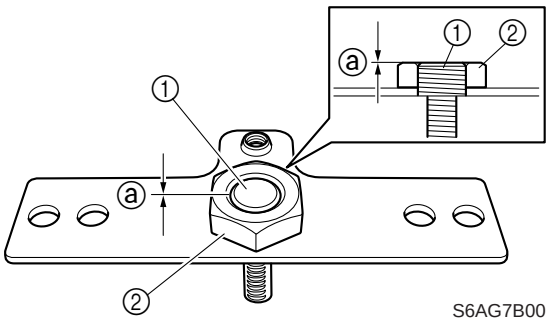
NOTE:
Before removing the friction plate bolts ①, turn the outboard motor all the way to port or starboard.

2. Disassemble the friction plate assembly.

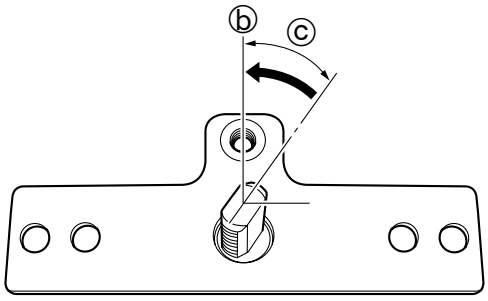
NOTE:
See the exploded diagram for disassembly (7-11).

Assembling the friction plate

1. Turn the steering lock shaft ① until it is flush with the end ⓐ of the nut ② on the bracket.



S6AG7B00



S6AG7B01

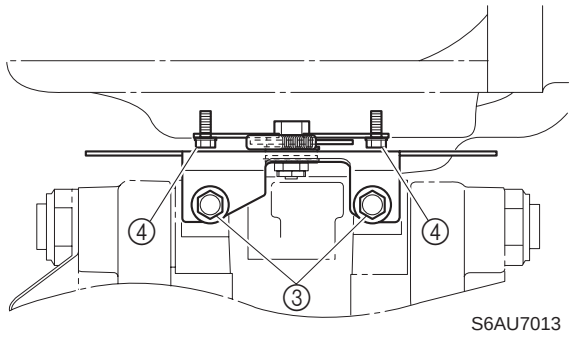
NOTE:
If the steering lock shaft is not aligned with position ⓑ, turn it less than 90° ⓒ until it is aligned.

2. Assemble the friction plate assembly.

NOTE:
- See the exploded diagram for assembly (7-11).
- Face the “TOP” mark on the steering lock lever up.
- Be sure to install the collars in the correct positions; the collar lengths are different.

7

3. Install the friction plate assembly onto the swivel bracket and tighten the friction plate bolts ③ and ④ temporarily.



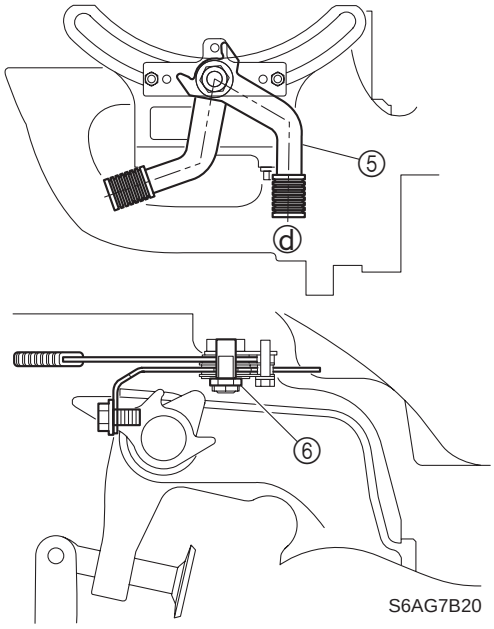
S6AU7013

NOTE:
Before installing the friction plate bolts ④, turn the outboard motor all the way to port or starboard.

4. Tighten the friction plate bolts ③ and ④ to the specified torques.

	Friction plate bolt (M8) ③: 18 N·m (1.8 kgf·m, 13.3 ft·lb) Friction plate bolt (M5) ④: 7 N·m (0.7 kgf·m, 5.2 ft·lb)

5. Move the steering lock lever ⑤ to position ⓓ, and then tighten the self-locking nut ⑥ to the specified torque.

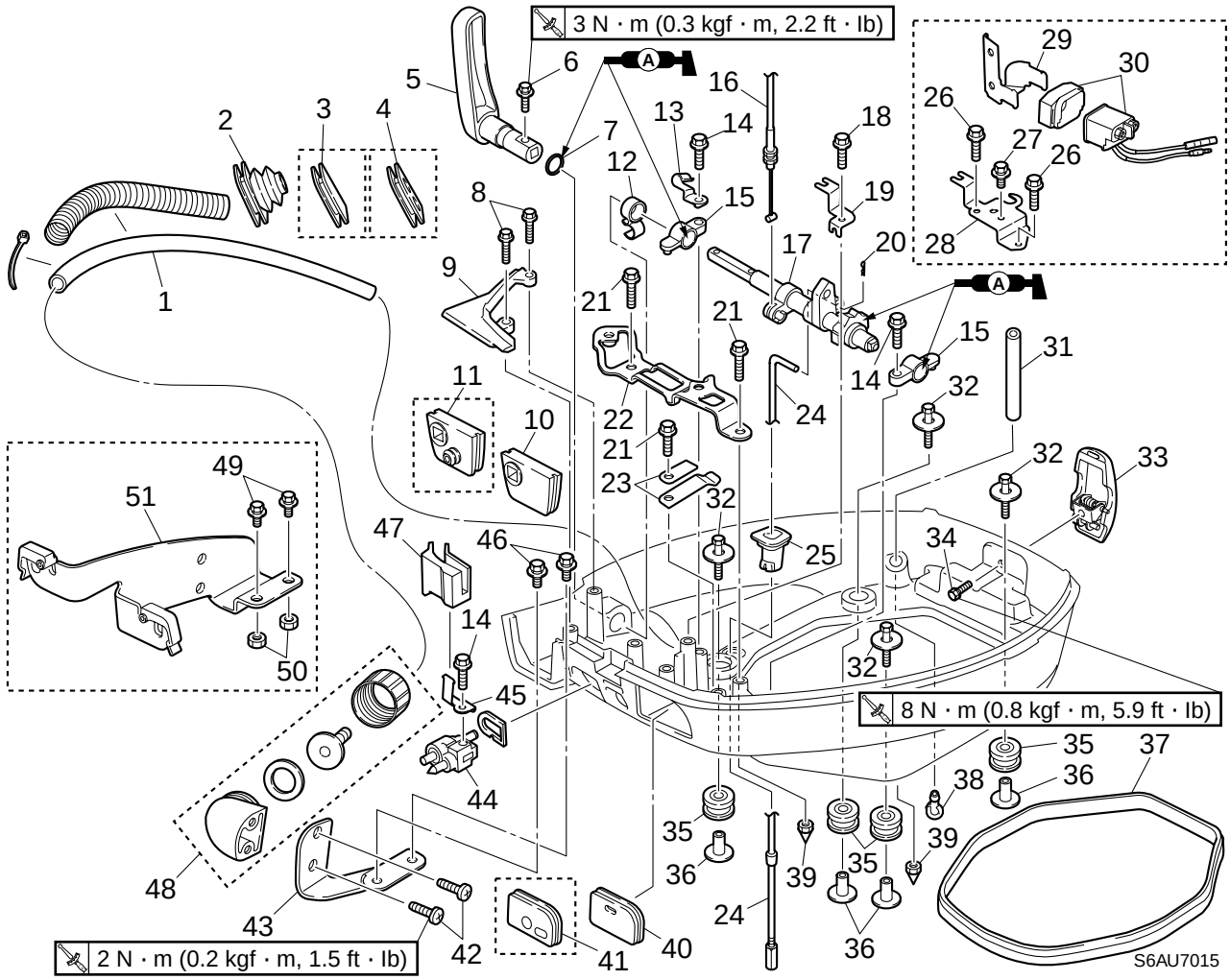


S6AG7B20

NOTE:
To check and adjust the friction plate, see "Checking the steering operation (H model)" (3-12).

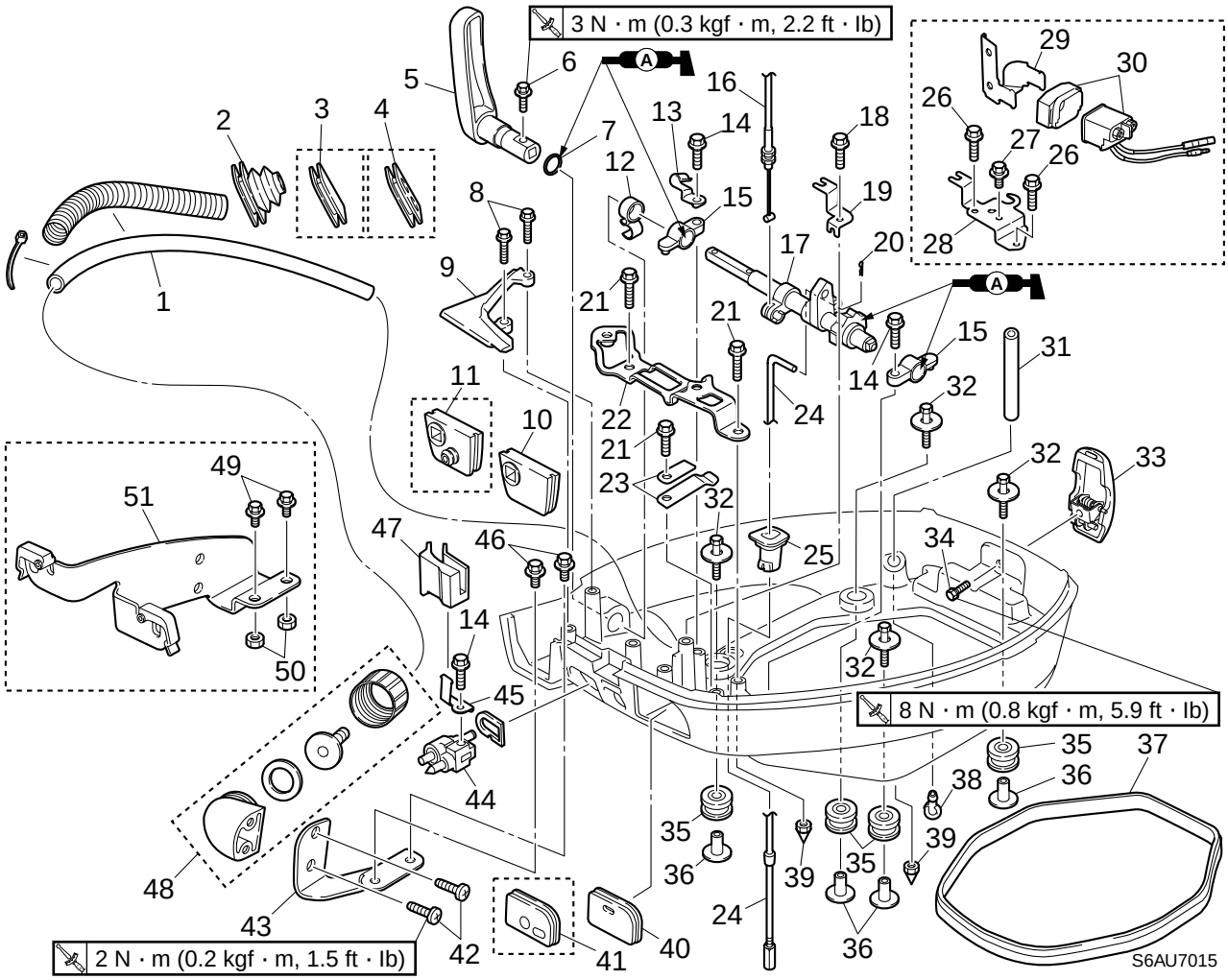
	Friction self-locking nut ⑥: 6 N·m (0.6 kgf·m, 4.4 ft·lb)

Bottom cowling

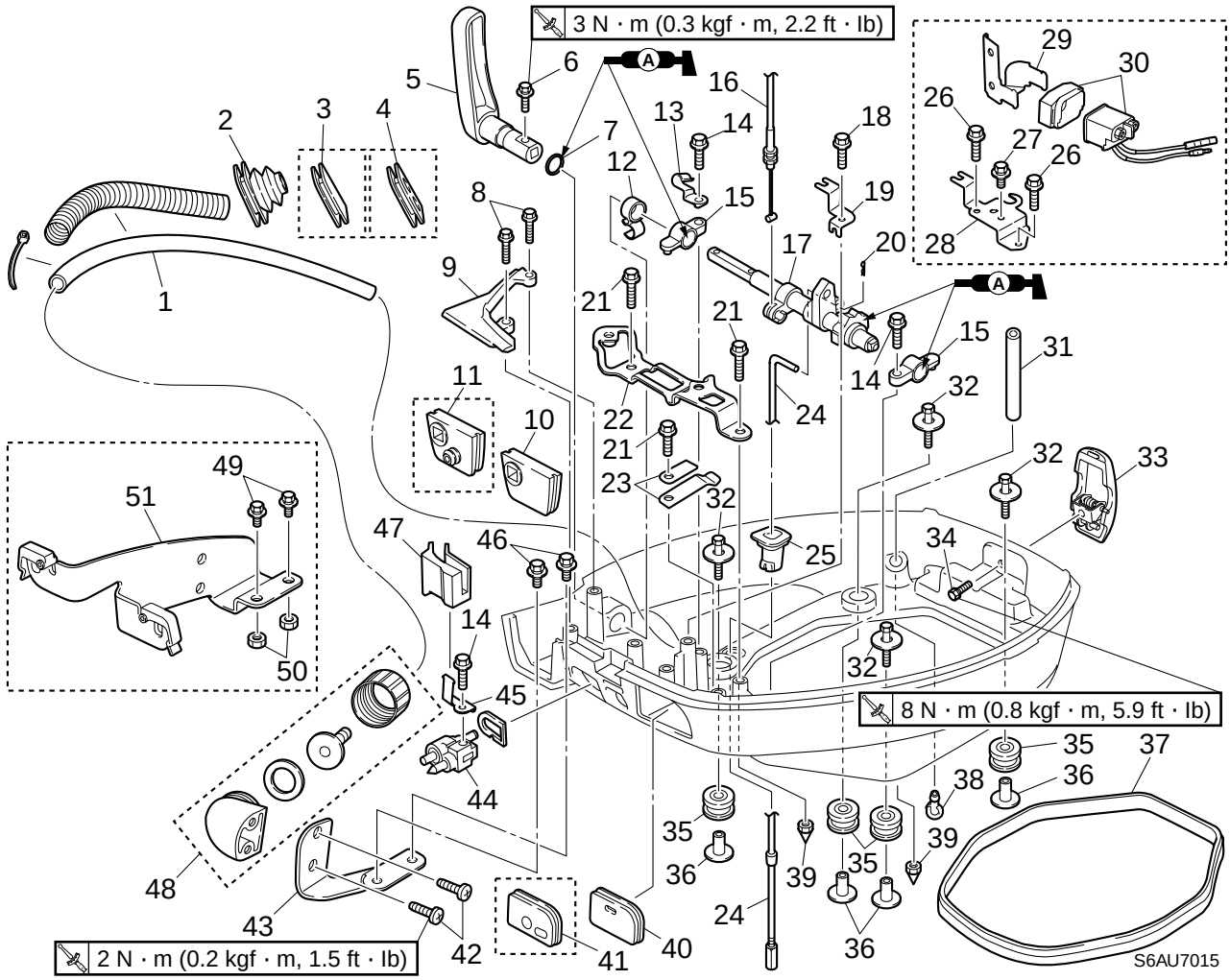


No.	Part name	Q'ty	Remarks
1	Flushing hose	1	For Europe
2	Grommet	1	
3	Grommet	1	For Oceania
4	Grommet	1	PT model
5	Shift lever	1	
6	Bolt	1	M5 × 16 mm
7	O-ring	1	**Not reusable**
8	Bolt	2	M6 × 25 mm
9	Retaining plate	1	
10	Grommet	1	H model
11	Grommet	1	R model
12	Holder	1	
13	Holder	1	PT model
14	Bolt	3	M6 × 25 mm
15	Bracket	2	
16	Start-in-gear protection cable	1	M model
17	Shift rod lever	1	

7



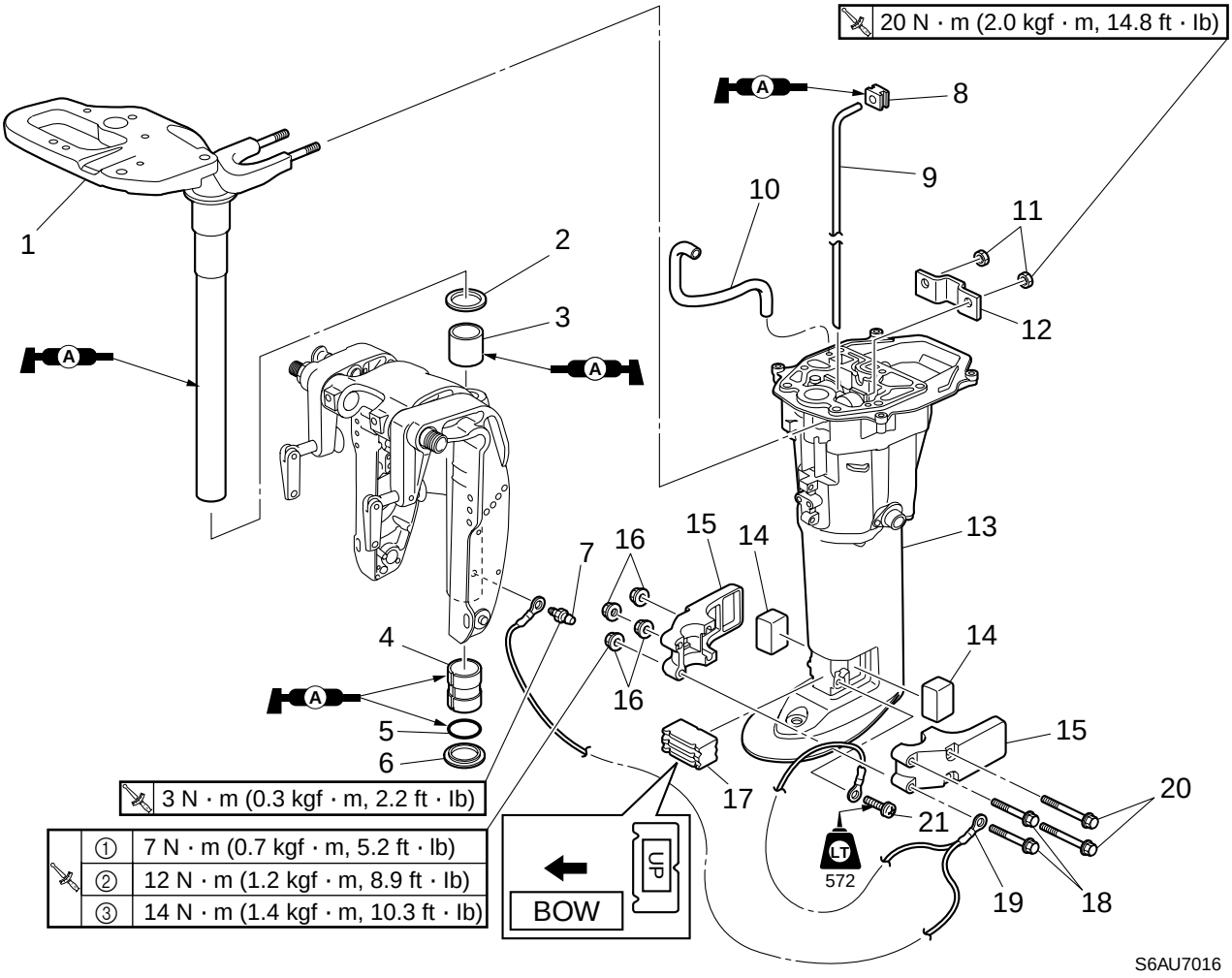
No.	Part name	Q'ty	Remarks
18	Bolt	1	M6 × 20 mm
19	Bracket	1	
20	Clip	1	
21	Bolt	3	M6 × 20 mm/PT model
22	Bracket	1	PT model
23	Spring	2	
24	Shift rod	1	
25	Grommet	1	
26	Bolt	2	M6 × 20 mm/E model
27	Bolt	1	M6 × 12 mm/E model
28	Bracket	1	E model
29	Bracket	1	E model
30	Starter relay	1	E model
31	Cooling water hose	1	
32	Bolt	4	M6 × 35 mm
33	Cowling lock lever	1	
34	Bolt	1	M6 × 12 mm



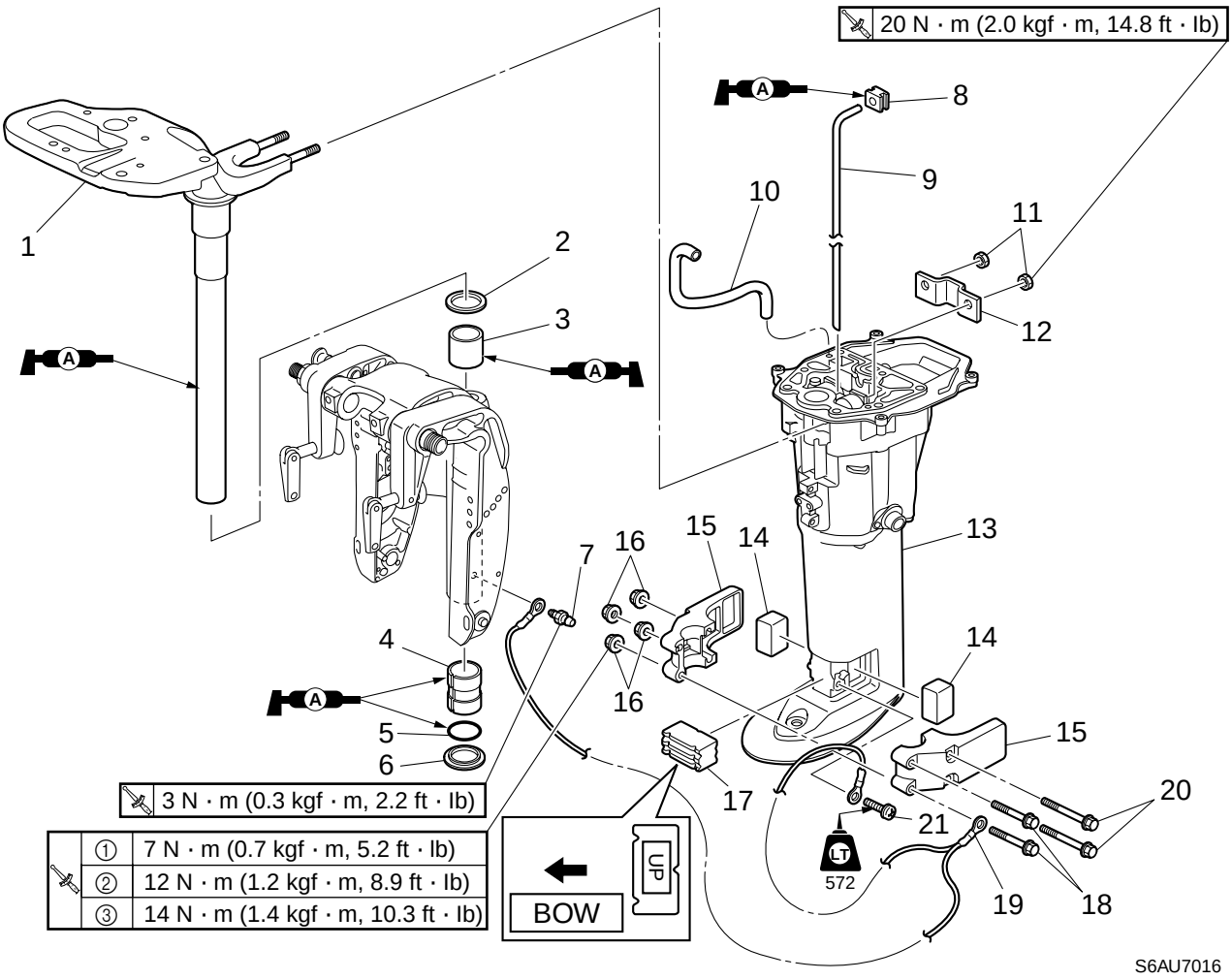
No.	Part name	Q'ty	Remarks
35	Grommet	4	
36	Collar	4	
37	Rubber seal	1	
38	Water outlet	1	
39	Grommet	2	
40	Grommet	1	H model
41	Grommet	1	R model
42	Screw	2	ø6 × 20 mm
43	Bracket	1	H model
44	Fuel joint	1	
45	Bracket	1	H model
46	Bolt	2	M6 × 10 mm/H model
47	Cable guide	1	H model
48	Adapter	1	
49	Bolt	2	M6 × 12 mm/R model
50	Nut	2	R model
51	Bracket	1	R model

7

Upper case and steering arm

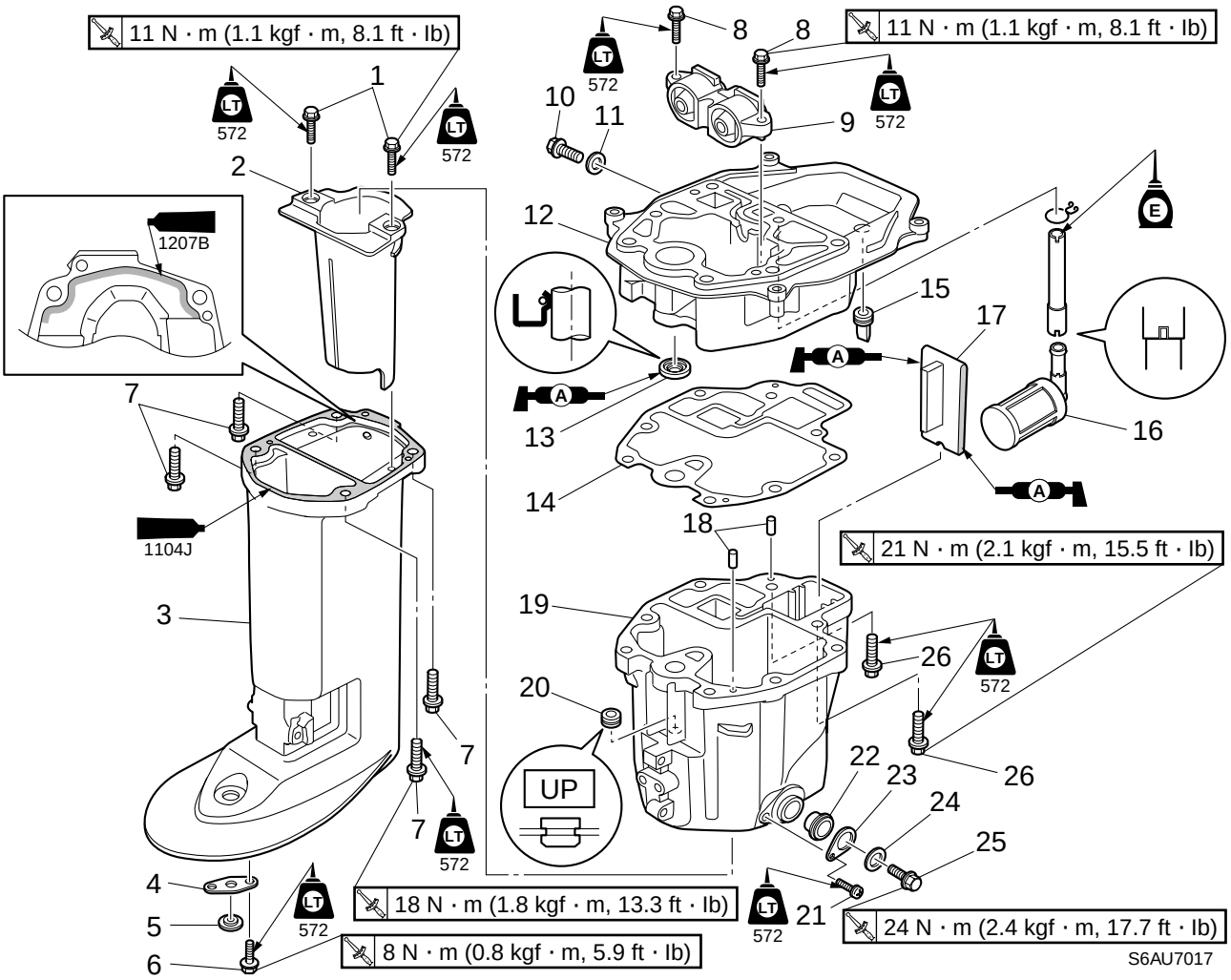

20 N · m (2.0 kgf · m, 14.8 ft · lb)
3 N · m (0.3 kgf · m, 2.2 ft · lb)
① 7 N · m (0.7 kgf · m, 5.2 ft · lb)
② 12 N · m (1.2 kgf · m, 8.9 ft · lb)
③ 14 N · m (1.4 kgf · m, 10.3 ft · lb)
BOW
UP
LT
572
S6AU7016

No.	Part name	Q'ty	Remarks
1	Steering arm	1	L-transom model/S-transom model
2	Washer	1	
3	Bushing 1	1	
4	Bushing 2	1	
5	O-ring	1	**Not reusable**
6	Plate	1	
7	Grease nipple	1	
8	Water seal rubber	1	
9	Water pipe	1	L-transom model/S-transom model
10	Hose	1	
11	Nut	2	
12	Plate	1	
13	Upper case assembly	1	L-transom model/S-transom model
14	Rubber damper	2	
15	Mount housing	2	
16	Nut	4	
17	Rubber damper	1	

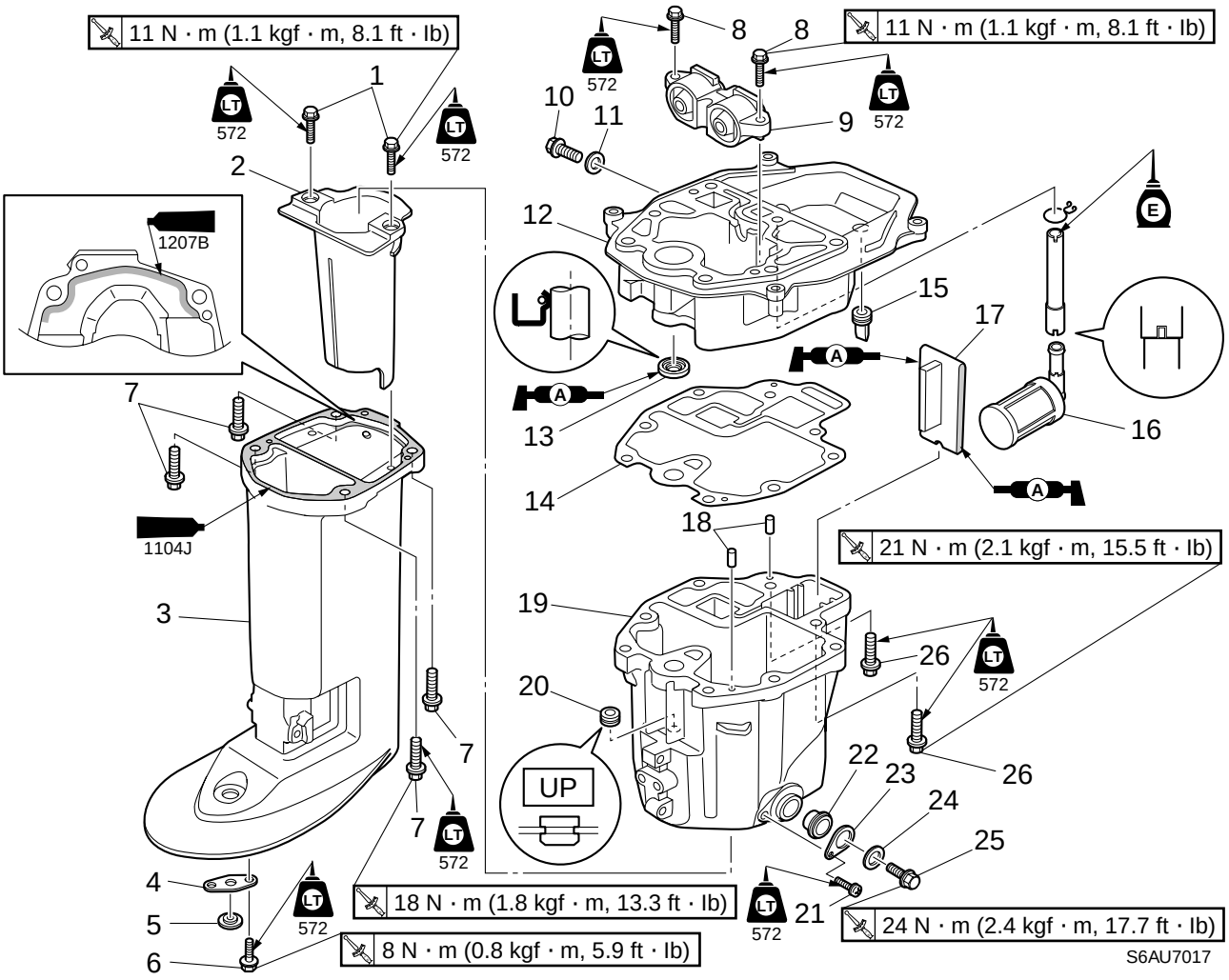

20 N · m (2.0 kgf · m, 14.8 ft · lb)
3 N · m (0.3 kgf · m, 2.2 ft · lb)
① 7 N · m (0.7 kgf · m, 5.2 ft · lb)
② 12 N · m (1.2 kgf · m, 8.9 ft · lb)
③ 14 N · m (1.4 kgf · m, 10.3 ft · lb)
BOW
UP
LT
572
S6AU7016

No.	Part name	Q'ty	Remarks
18	Bolt	2	M6 × 55 mm
19	Ground lead	1	
20	Bolt	2	M6 × 85 mm
21	Screw	1	ø5 × 7 mm

7


11 N · m (1.1 kgf · m, 8.1 ft · lb)
11 N · m (1.1 kgf · m, 8.1 ft · lb)
21 N · m (2.1 kgf · m, 15.5 ft · lb)
18 N · m (1.8 kgf · m, 13.3 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
24 N · m (2.4 kgf · m, 17.7 ft · lb)
572
1207B
1104J
UP
S6AU7017

No.	Part name	Q'ty	Remarks
1	Bolt	2	M6 × 14 mm
2	Exhaust manifold	1	
3	Upper case	1	L-transom model/S-transom model
4	Plate	1	
5	Grommet	1	
6	Bolt	1	M6 × 8 mm
7	Bolt	4	M8 × 35 mm
8	Bolt	2	M6 × 25 mm
9	Upper mount	1	
10	Bolt	1	M8 × 14 mm
11	Washer	1	
12	Exhaust guide	1	
13	Oil seal	1	**Not reusable**
14	Gasket	1	**Not reusable**
15	Grommet	1	
16	Oil strainer	1	
17	Baffle plate	1	

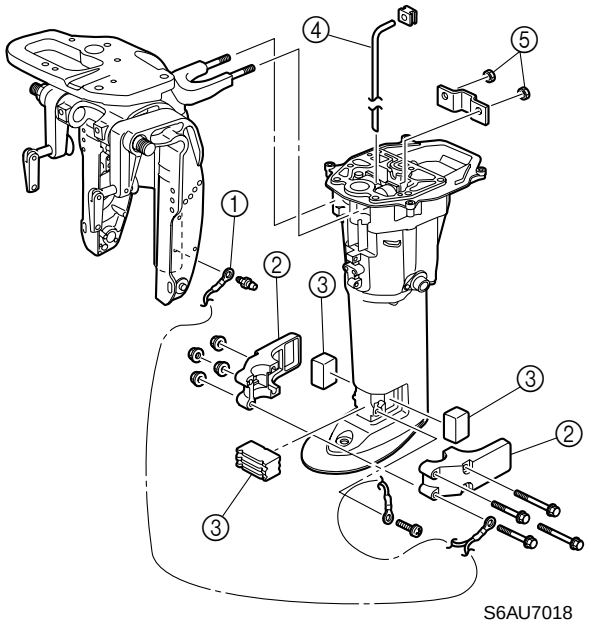

11 N · m (1.1 kgf · m, 8.1 ft · lb)
11 N · m (1.1 kgf · m, 8.1 ft · lb)
21 N · m (2.1 kgf · m, 15.5 ft · lb)
18 N · m (1.8 kgf · m, 13.3 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
24 N · m (2.4 kgf · m, 17.7 ft · lb)
572
1207B
1104J
UP
S6AU7017

No.	Part name	Q'ty	Remarks
18	Dowel	2	
19	Oil pan	1	
20	Rubber seal	1	
21	Screw	1	ø5 × 7 mm
22	Grommet	1	
23	Plate	1	
24	Gasket	1	**Not reusable**
25	Drain bolt	1	
26	Bolt	2	M8 × 30 mm

Removing the upper case

NOTE:
- Drain the engine oil before removing the upper case assembly.
- Be sure to remove the shift rod assembly before removing the upper case assembly from the clamp bracket.

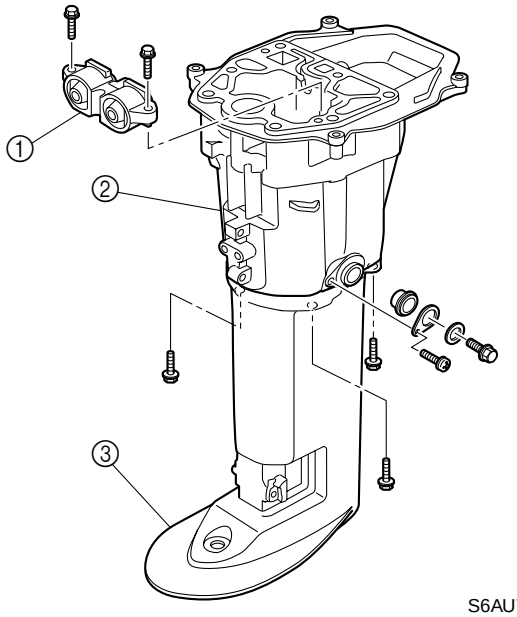
1. Remove the ground lead terminal ① from the swivel bracket.
2. Remove the mount housings ②, and then remove the rubber dampers ③.
3. Remove the water pipe ④.
4. Remove the upper mounting nuts ⑤, and then remove the upper case assembly.



S6AU7018

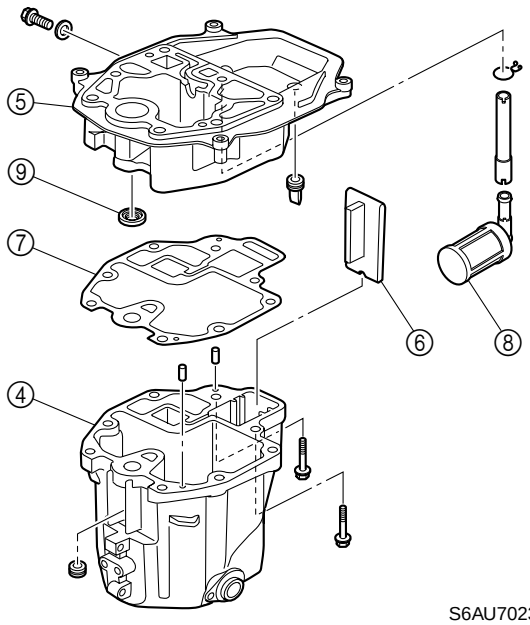
Disassembling the upper case

1. Remove the engine oil drain bolt and grommet.
2. Remove the upper mount ① from the upper case assembly.
3. Remove the oil pan assembly ② from the upper case ③.



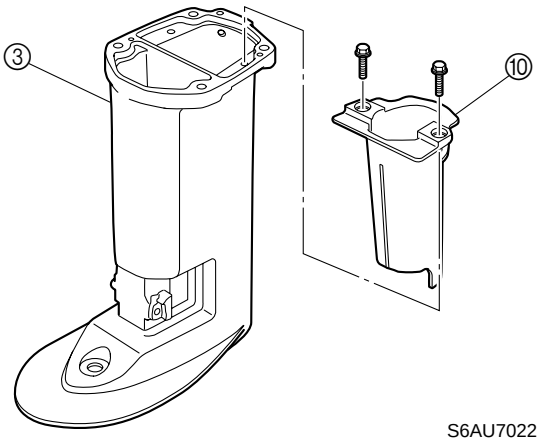
S6AU7019

4. Remove the oil pan ④ from the exhaust guide ⑤, baffle plate ⑥, and gasket ⑦.
5. Remove the oil strainer ⑧ from the exhaust guide.
6. Remove the oil seal ⑨ from the exhaust guide.



S6AU7023

7. Remove the exhaust manifold ⑩ from the upper case ③.



S6AU7022

Checking the exhaust manifold, oil pan, and exhaust guide

1. Check the exhaust manifold, oil pan, and exhaust guide. Replace if cracked or corroded.

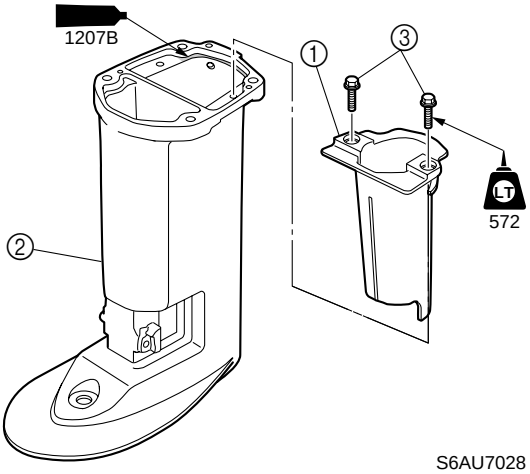
NOTE:
Clean the removed parts before checking them.

Checking the oil strainer

1. Check the oil strainer. Clean if there is dirt or residue.

Assembling the upper case

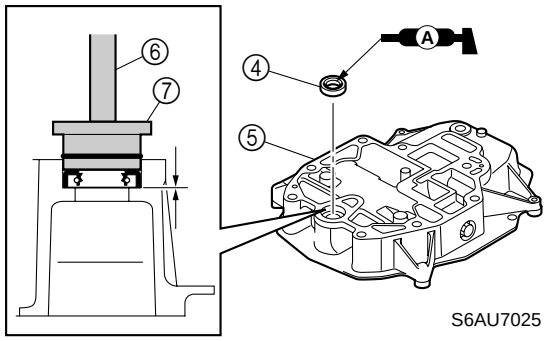
1. Install the exhaust manifold ① to the upper case ②, and then tighten the exhaust manifold bolts ③ to the specified torque.



S6AU7028

Exhaust manifold bolt ③:
11 N·m (1.1 kgf·m, 8.1 ft·lb)

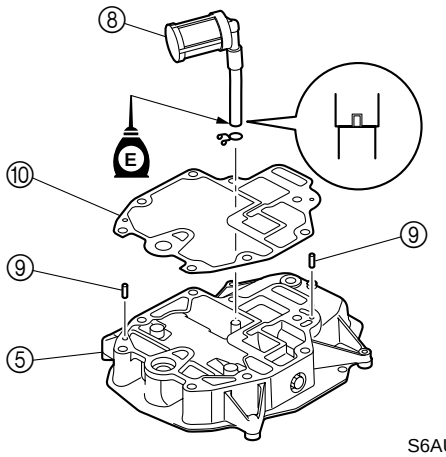
2. Install a new oil seal ④ into the exhaust guide ⑤.



S6AU7025

Driver rod L3 ⑥: 90890-06652
Needle bearing attachment ⑦:
90890-06614

3. Install the oil strainer ⑧, the dowels ⑨, and a new gasket ⑩ onto the exhaust guide ⑤.



S6AU7026

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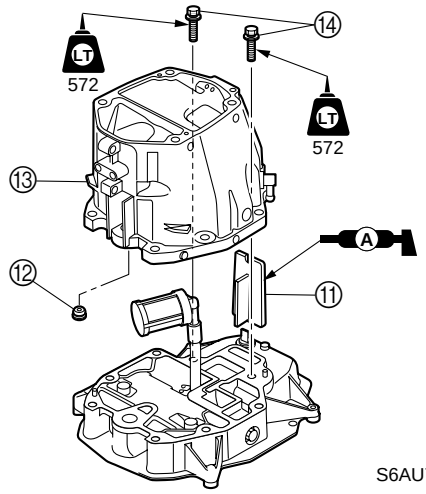
4. Install the baffle plate ⑪ and rubber seal ⑫ to the oil pan ⑬, and then tighten the oil pan bolts ⑭ to the specified torque.

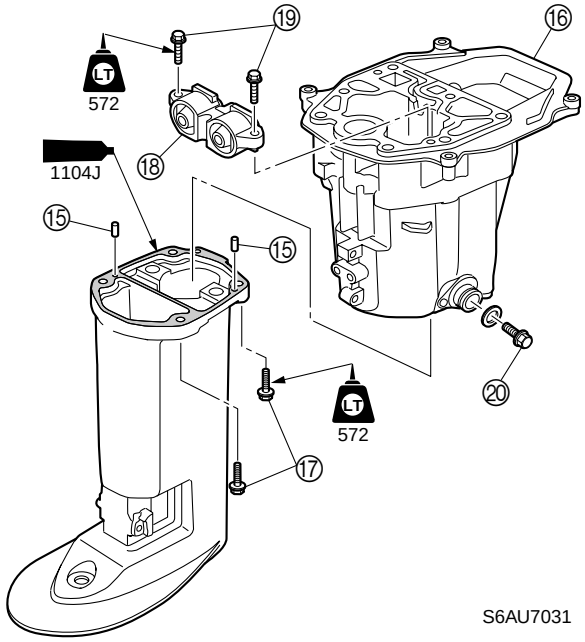


S6AU7027

Oil pan bolt ⑭:
21 N·m (2.1 kgf·m, 15.5 ft·lb)

5. Install the dowels ⑮ and oil pan assembly ⑯, and then tighten the upper case bolts ⑰ to the specified torque.

6. Install the upper mount ⑱, and then tighten the upper mount bolts ⑲ to the specified torque.



S6AU7031

NOTE:
Apply sealant (1104J) to the mating surface.

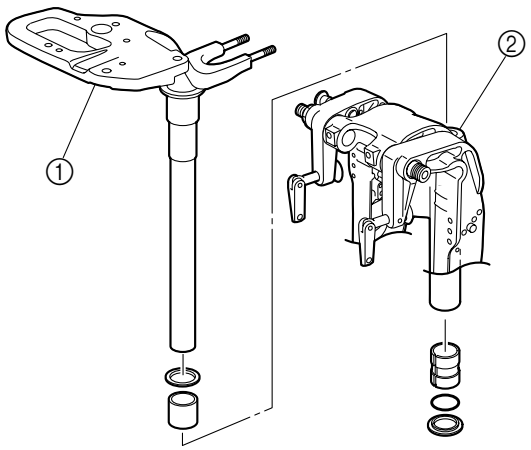
Upper case bolt ⑰:
18 N·m (1.8 kgf·m, 13.3 ft·lb)
Upper mount bolt ⑲:
11 N·m (1.1 kgf·m, 8.1 ft·lb)

7. Install the grommet and engine oil drain bolt ⑳, and then tighten the drain bolt to the specified torque.

Engine oil drain bolt ⑳:
24 N·m (2.4 kgf·m, 17.7 ft·lb)

Removing the steering arm

1. Remove the steering arm ① from the swivel bracket ② by pulling the arm off the bracket.



S6AU7032

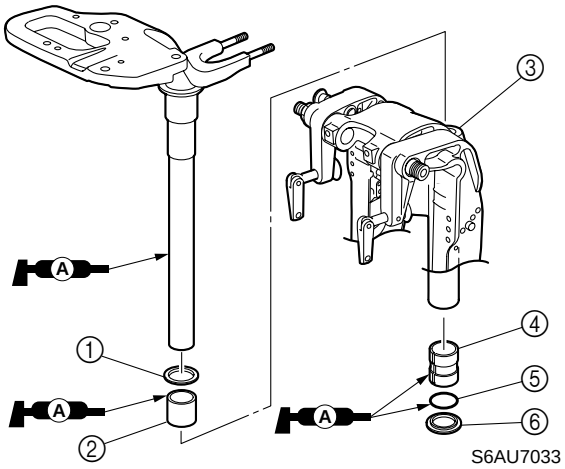
NOTE:
To disassemble the clamp brackets, see "Removing the clamp bracket" (7-28) or "Removing the clamp bracket" (7-33).

Installing the steering arm

1. Install the washer ① and bushing 1 ② onto the steering arm.

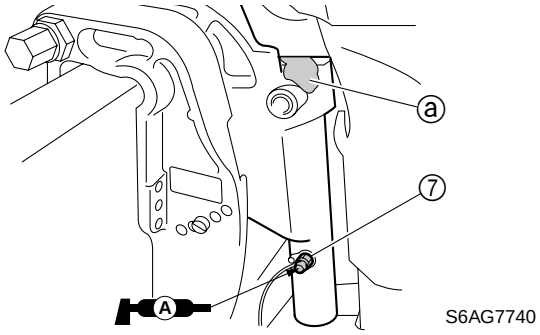
2. Place the swivel bracket ③ in an upright position, and then install the steering arm onto the swivel bracket.

3. Install bushing 2 ④, a new O-ring ⑤, and the plate ⑥ onto the swivel bracket.



S6AU7033

4. Apply grease to the grease nipple ⑦ on the swivel bracket until it comes out from the upper bushing ⓐ.



S6AG7740

NOTE:
To assemble the clamp brackets, see "Installing the clamp bracket" (7-30) or "Installing the clamp bracket" (7-34).

Installing the upper case

1. Install the upper case assembly ① to the clamp bracket.

2. Install the plate and upper mounting nuts ②, and then tighten the upper mounting nuts to the specified torque.

3. Install the ground lead terminal ③ to the upper case as shown.

4. Install the rubber dampers ④ and ⑤ (front), and then install the mount housings ⑥ and ground lead terminal ⑦ using the mount housing bolts ⑧ and ⑨ and the mount housing nuts ⑩.

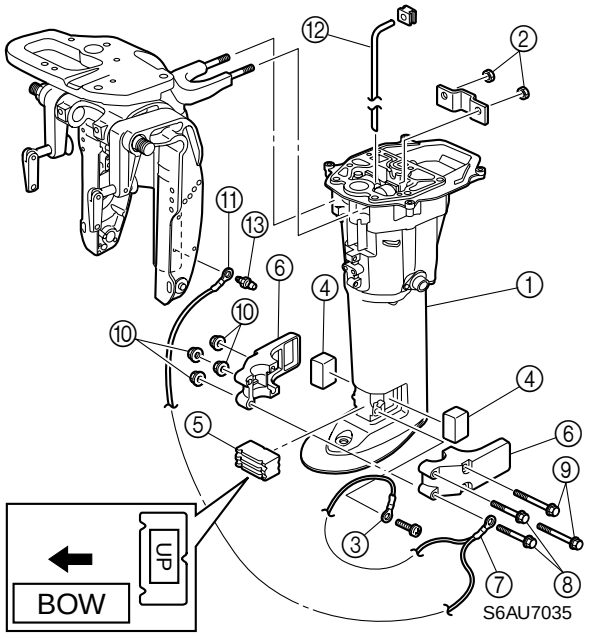
NOTE:
Install the ground lead terminal ⑦ so that it is within the range ⓐ (30°) shown.

5. Tighten the mount housing nuts ⑩ to the specified torques in 3 stages and in the sequence shown.

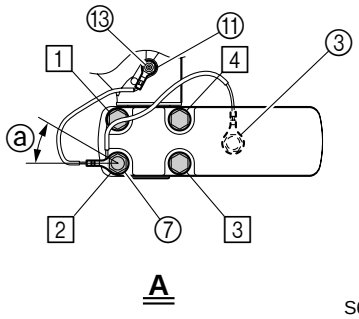
NOTE:
Tighten the mount housing nuts ⑩ evenly and in the following order: 1–2–3–4.

6. Install the ground lead terminal ⑪ to the swivel bracket.

7. Install the water pipe ⑫.



S6AU7035

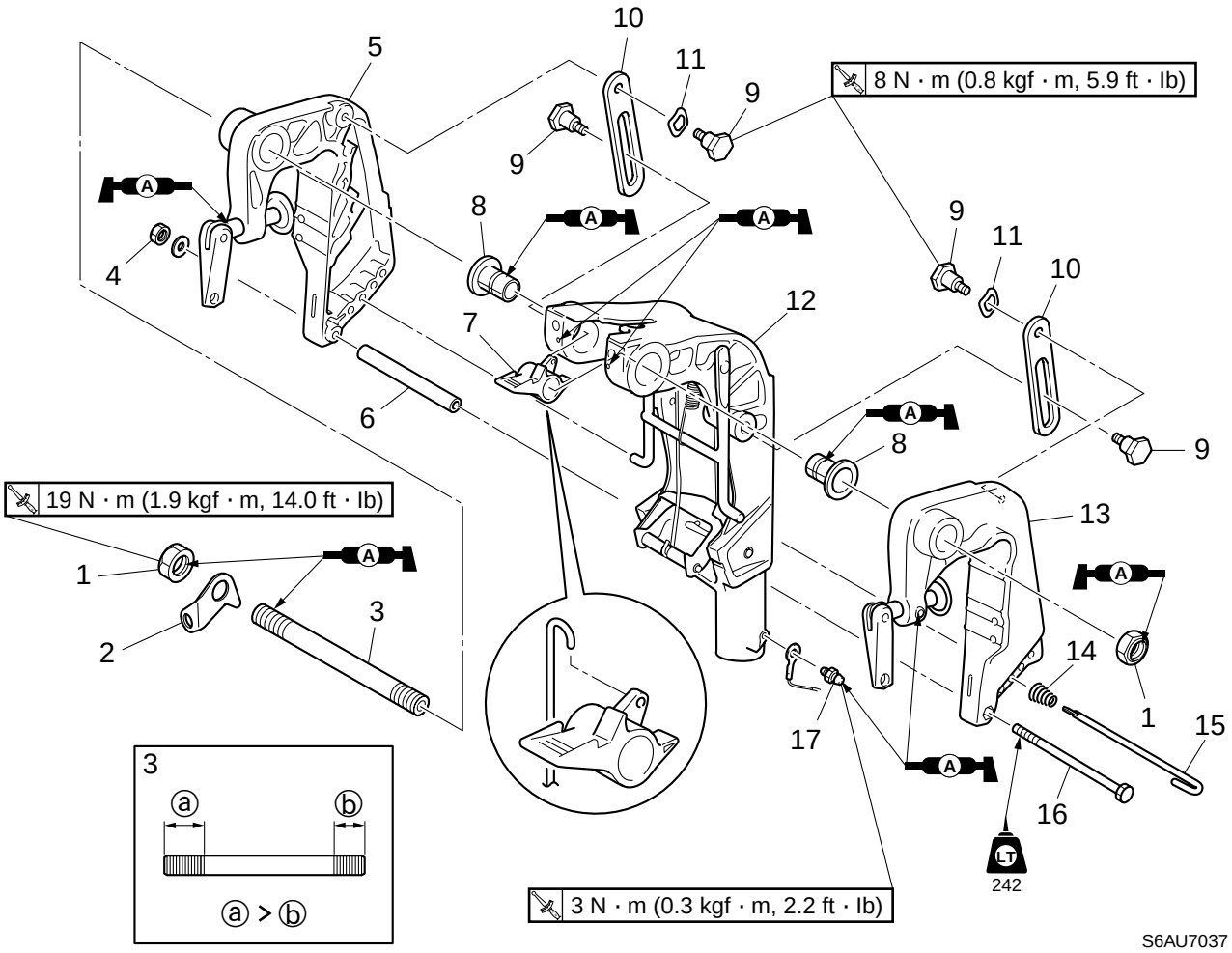


S6AU7036

Bracket unit

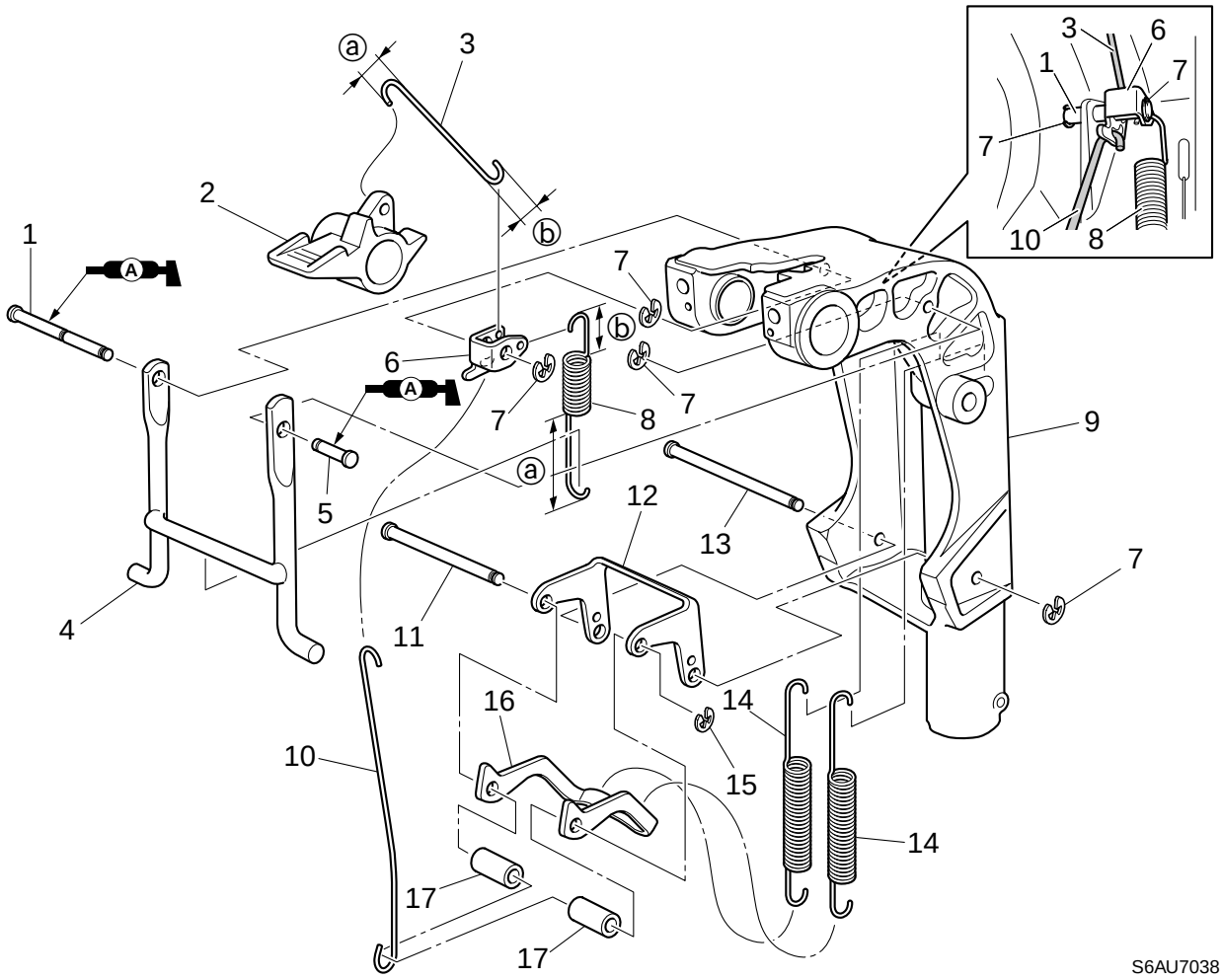
Upper mounting nut ②:
20 N·m (2.0 kgf·m, 14.8 ft·lb)
Mount housing nut ⑩:
1st: 7 N·m (0.7 kgf·m, 5.2 ft·lb)
2nd: 12 N·m (1.2 kgf·m, 8.9 ft·lb)
3rd: 14 N·m (1.4 kgf·m, 10.3 ft·lb)
Grease nipple ⑬:
3 N·m (0.3 kgf·m, 2.2 ft·lb)

Clamp bracket and swivel bracket (MT model)



No.	Part name	Q'ty	Remarks
1	Self-locking nut	2	
2	Plate	1	
3	Through tube	1	
4	Nut	1	
5	Clamp bracket	1	STBD
6	Collar	1	
7	Tilt lock lever	1	
8	Bushing	2	
9	Bolt	4	
10	Tilt stopper plate	2	
11	Wave washer	2	
12	Swivel bracket	1	L-transom model/S-transom model
13	Clamp bracket	1	PORT
14	Spring	1	
15	Tilt pin	1	
16	Bolt	1	M6 × 155 mm
17	Grease nipple	1	

7



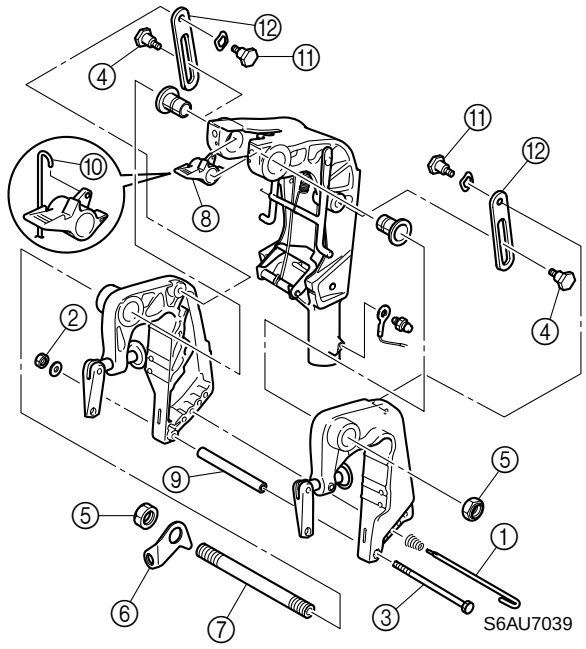
No.	Part name	Q'ty	Remarks
1	Tilt lever shaft	1	
2	Tilt lock lever	1	
3	Tilt lock rod 1	1	ⓐ > ⓑ
4	Tilt support bar	1	
5	Stopper shaft	1	
6	Tilt lever	1	
7	E-clip	4	
8	Spring	1	ⓐ > ⓑ
9	Swivel bracket	1	L-transom model/S-transom model
10	Tilt lock rod 2	1	
11	Pin 1	1	
12	Tilt lock plate 2	1	
13	Pin 2	1	
14	Spring	2	
15	E-clip	1	
16	Tilt lock plate 1	1	
17	Collar	2	

Removing the clamp bracket

1. Remove the tilt pin ①, clamp bracket nut ②, and clamp bracket bolt ③.
2. Remove the tilt stopper plate bolts ④ (swivel bracket side).
3. Remove the self-locking nuts ⑤ and plate ⑥.
4. Remove the through tube ⑦, tilt lock lever ⑧, and collar ⑨, and then disassemble the clamp brackets.

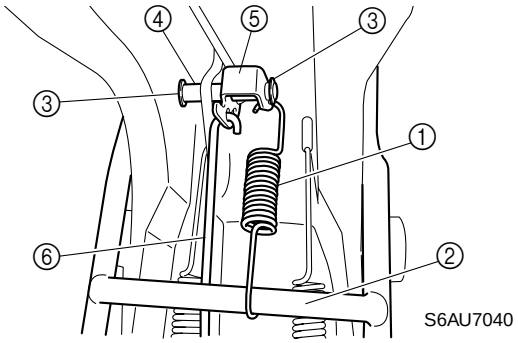
NOTE:
Unhook tilt lock rod 1 ⑩ from the tilt lock lever ⑧ when removing the lever.

5. Remove the tilt stopper plate bolts ⑪ (clamp bracket side) and tilt stopper plates ⑫.



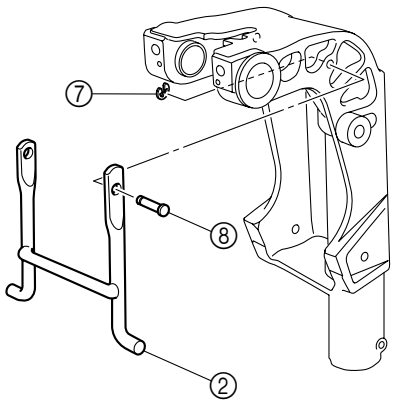
Disassembling the swivel bracket

1. Unhook the spring ① from the tilt support bar ②. Remove the E-clips ③ from the tilt lever shaft ④, and then pull out the shaft and remove the tilt lever ⑤.



NOTE:
Unhook tilt lock rod 2 ⑥ from the tilt lever ⑤ when removing the lever.

2. Remove the E-clip ⑦ from the stopper shaft ⑧, and then pull out the shaft and remove the tilt support bar ②.

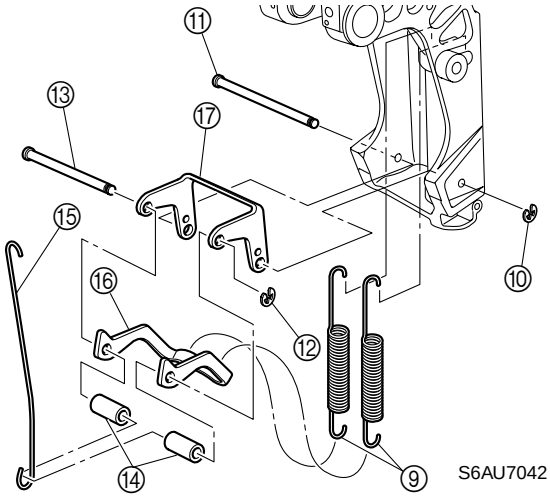


7

3. Remove the springs ⑨.

4. Remove the E-clip ⑩ from pin 2 ⑪, and then pull out the pin.

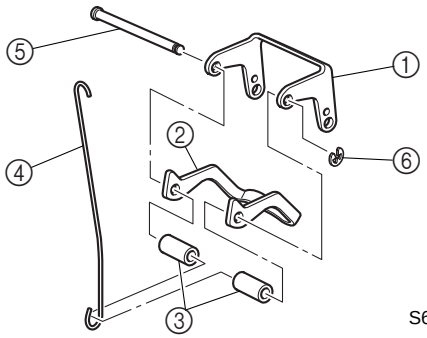
5. Remove the E-clip ⑫ from pin 1 ⑬, and then pull out the pin and remove the collars ⑭, tilt lock rod 2 ⑮, tilt lock plate 1 ⑯, and tilt lock plate 2 ⑰.



S6AU7042

Assembling the swivel bracket

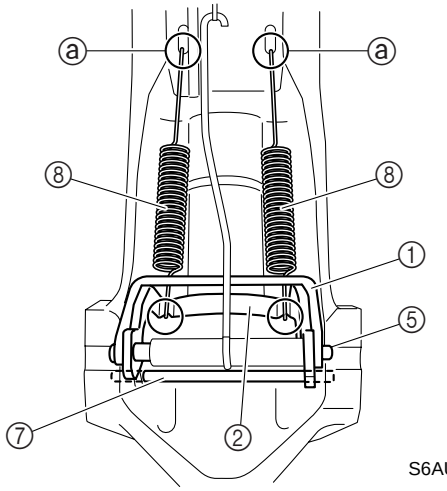
1. Assemble tilt lock plate 2 ①, tilt lock plate 1 ②, the collars ③, tilt lock rod 2 ④, and pin 1 ⑤, and then install the E-clip ⑥.



S6AG7970

NOTE:
After installing the E-clip, turn it to make sure that it is installed securely.

2. Pass pin 2 ⑦ through the swivel bracket and tilt lock plate 2 ①, and then install the E-clip. Hook the springs ⑧ onto tilt lock plate 1 ②, and then hook them onto the holes ⓐ in the swivel bracket.



S6AU7044

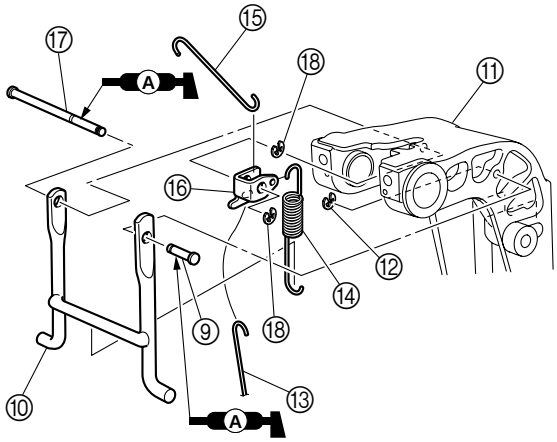
NOTE:
After installing the E-clip, turn it to make sure that it is installed securely.

3. Install the stopper shaft ⑨ and tilt support bar ⑩ to the swivel bracket ⑪, and then install the E-clip ⑫.

4. Hook tilt lock rod 2 ⑬, the spring ⑭, and tilt lock rod 1 ⑮ onto the tilt lever ⑯.

5. Install the tilt lever shaft ⑰ into the swivel bracket ⑪, making sure to pass the shaft through the tilt support bar ⑩ and tilt lever ⑯, and then install the E-clips ⑱.

6. Hook the spring ⑭ onto the tilt support bar ⑩.



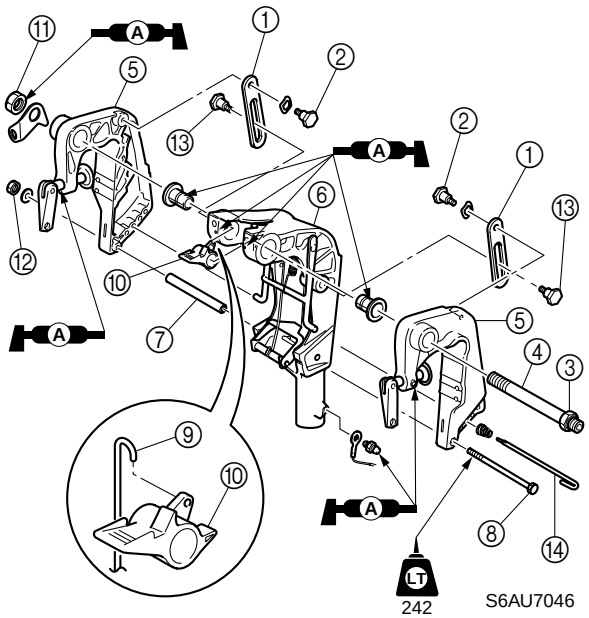
S6AG7A20J

NOTE:
- See the exploded diagram for the installation directions of the spring ⑭ and tilt lock rod 1 ⑮ (7-27).
- Make sure that the E-clips are installed securely.

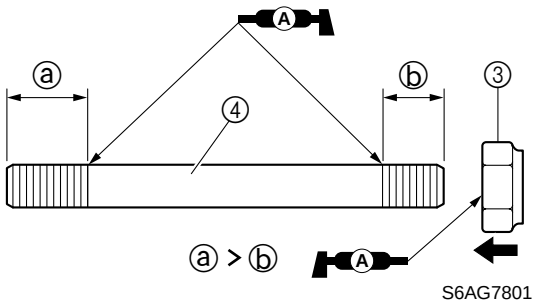
Installing the clamp bracket

1. Install the tilt stopper plates ① and tilt stopper plate bolts ② (clamp bracket side) to the clamp brackets, and then tighten the bolts to the specified torque.

	Tilt stopper plate bolt ②: 8 N·m (0.8 kgf·m, 5.9 ft·lb)



2. Tighten the self-locking nut ③ completely onto the shorter threaded end of the through tube ④.



3. Assemble the clamp brackets ⑤ and swivel bracket ⑥, and then install the collar ⑦, clamp bracket bolt ⑧, and through tube ④ from the port side.

NOTE:
When installing the through tube ④, hook tilt lock rod 1 ⑨ onto the tilt lock lever ⑩.

4. Install the self-locking nut ⑪ onto the through tube ④, and then tighten it to the specified torque.

	Self-locking nut ⑪: 19 N·m (1.9 kgf·m, 14.0 ft·lb)

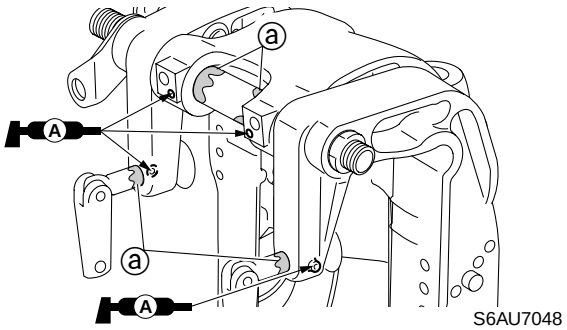
5. Tighten the clamp bracket nut ⑫.

6. Install the tilt stopper plates ① and tilt stopper plate bolts ⑬ (swivel bracket side) to the swivel bracket, and then tighten the bolts to the specified torque.

	Tilt stopper plate bolt ⑬: 8 N·m (0.8 kgf·m, 5.9 ft·lb)

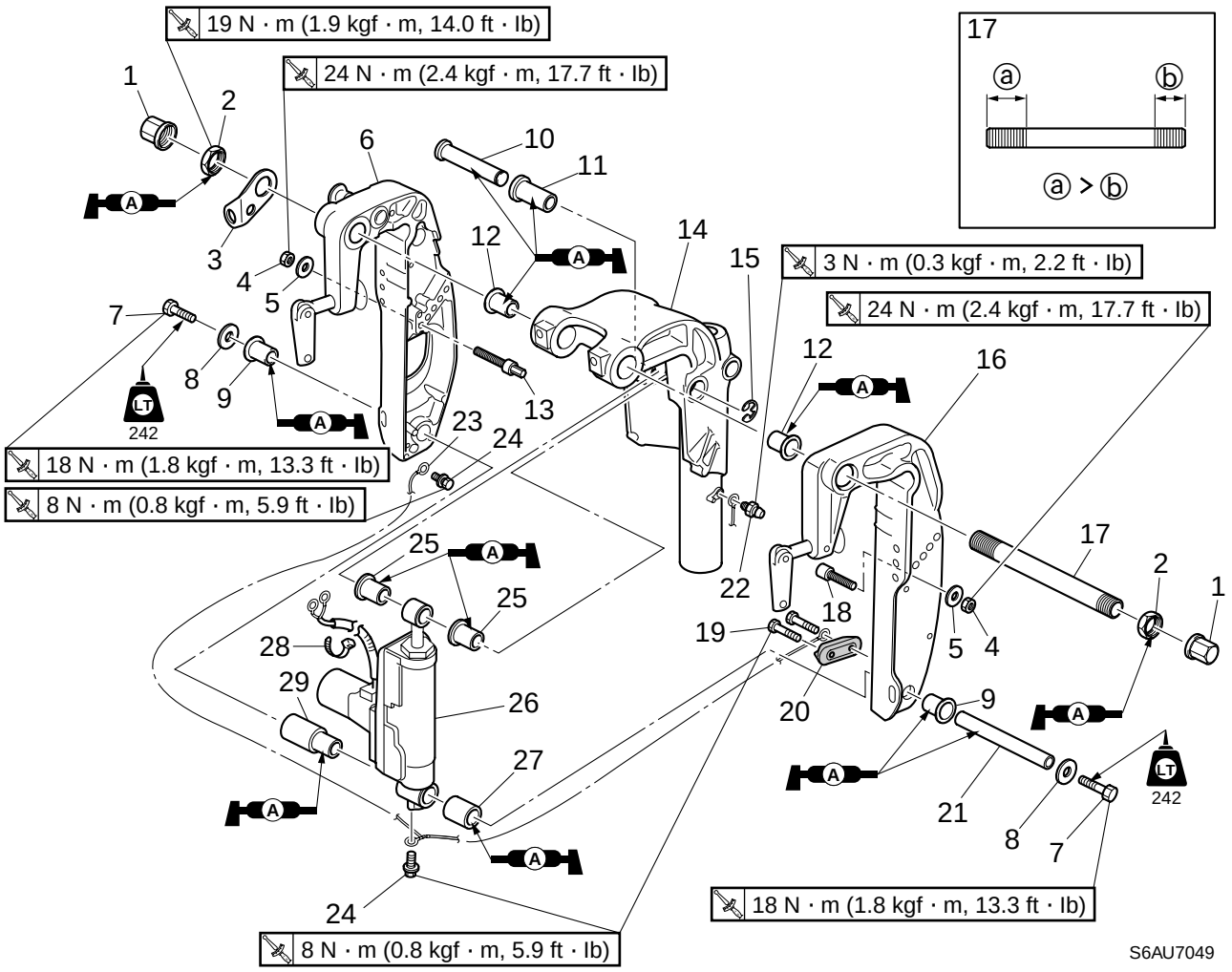
7. Install the tilt pin ⑭.

8. Apply grease to all grease nipples until it comes out from the areas ⓐ.

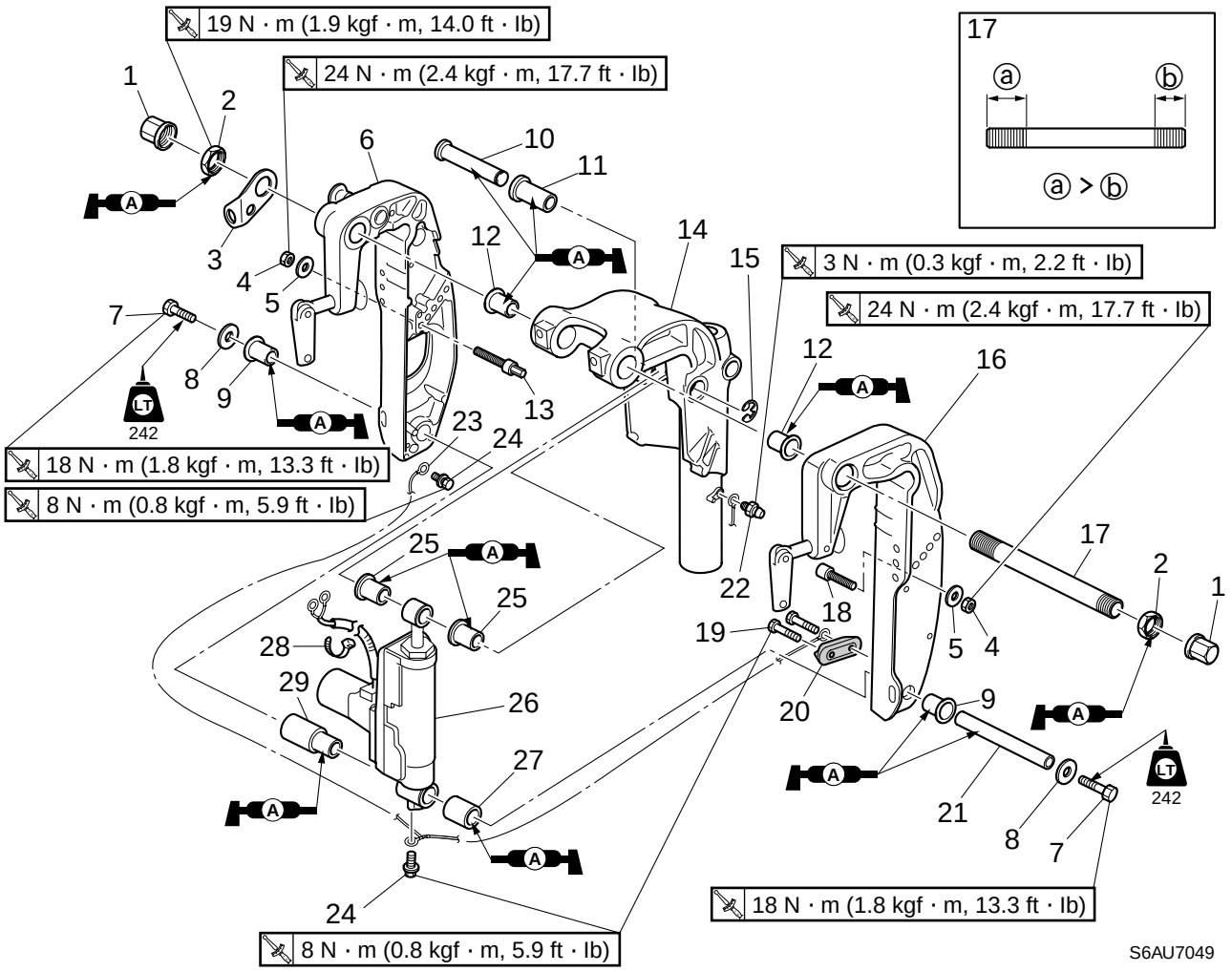


NOTE:
To check the tilt operation, see “Checking the tilt system (MT model)” (1-17).

Clamp bracket and swivel bracket (PT model)


19 N · m (1.9 kgf · m, 14.0 ft · lb)
24 N · m (2.4 kgf · m, 17.7 ft · lb)
3 N · m (0.3 kgf · m, 2.2 ft · lb)
24 N · m (2.4 kgf · m, 17.7 ft · lb)
18 N · m (1.8 kgf · m, 13.3 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
18 N · m (1.8 kgf · m, 13.3 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
17
ⓐ
ⓑ
ⓐ > ⓑ
LT
242
S6AU7049

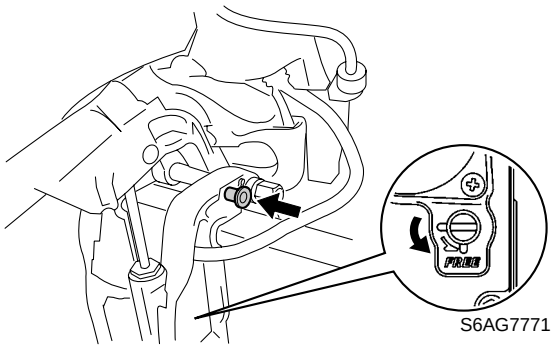
No.	Part name	Q'ty	Remarks
1	Cap	2	
2	Self-locking nut	2	
3	Plate	1	
4	Nut	2	
5	Washer	2	
6	Clamp bracket	1	STBD
7	Bolt	2	M8 × 16 mm
8	Washer	2	
9	Collar	2	
10	Shaft	1	
11	Collar	1	
12	Collar	2	
13	Stopper 1	1	
14	Swivel bracket	1	
15	E-clip	1	**Not reusable**
16	Clamp bracket	1	PORT
17	Through tube	1	


19 N · m (1.9 kgf · m, 14.0 ft · lb)
24 N · m (2.4 kgf · m, 17.7 ft · lb)
17
ⓐ
ⓑ
ⓐ > ⓑ
3 N · m (0.3 kgf · m, 2.2 ft · lb)
24 N · m (2.4 kgf · m, 17.7 ft · lb)
18 N · m (1.8 kgf · m, 13.3 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
242
18 N · m (1.8 kgf · m, 13.3 ft · lb)
8 N · m (0.8 kgf · m, 5.9 ft · lb)
S6AU7049

No.	Part name	Q'ty	Remarks
18	Stopper 2	1	
19	Bolt	2	M6 × 25 mm
20	Anode	1	
21	Shaft	1	
22	Grease nipple	1	
23	Ground lead	1	
24	Bolt	2	M6 × 10 mm
25	Collar	2	
26	PT unit	1	
27	Collar	1	
28	Plastic tie	1	
29	Collar	1	

Removing the PT unit

1. Fully tilt the outboard motor up, and then support it with the tilt stop lever.



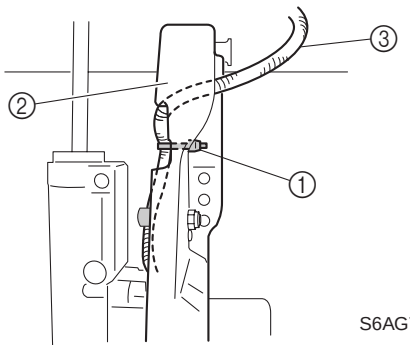
⚠ WARNING

After tilting up the outboard motor, be sure to support it with the tilt stop lever. Otherwise, the outboard motor could suddenly lower if the PT unit should lose fluid pressure.

NOTE:

If the PT unit does not operate, open the manual valve by turning it counterclockwise, and then tilt the outboard motor up manually.

2. Remove the plastic tie ① from the clamp bracket ②, and then pull out the PT motor lead ③.

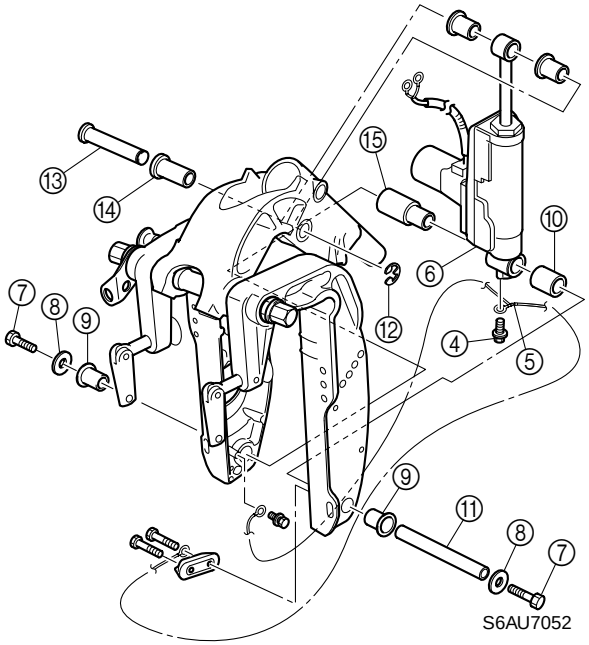


3. Remove the bolt ④ and ground lead ⑤ from the PT unit ⑥.

4. Remove the bolts ⑦, washers ⑧, collars ⑨ and ⑩, and shaft ⑪.

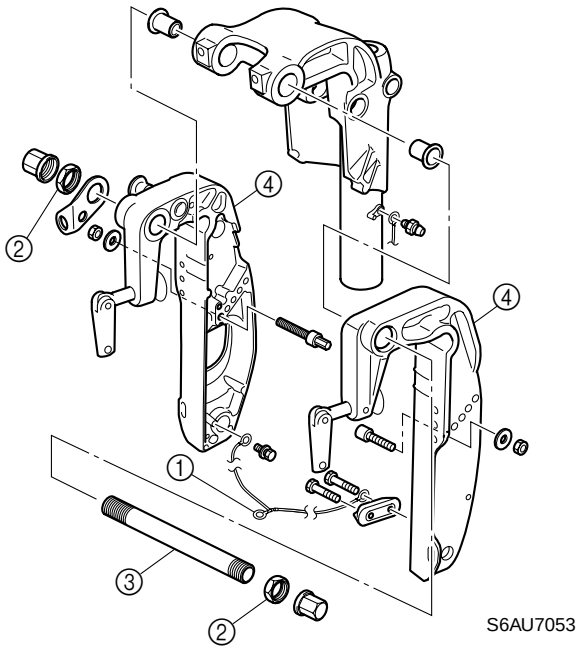
5. Remove the E-clip ⑫, shaft ⑬, and collar ⑭, and then remove the upper end of the tilt rod from the swivel bracket.

6. Remove the PT unit ⑥, and then remove the collar ⑮.



Removing the clamp bracket

1. Remove the ground lead terminal ①, self-locking nuts ②, and through tube ③, and then remove the clamp brackets ④.

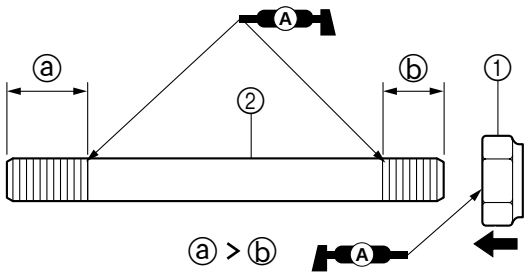


NOTE:

Be sure to remove the ground lead terminal ① before removing the self-locking nuts ②.

Installing the clamp bracket

1. Tighten the self-locking nut ① completely onto the shorter threaded end of the through tube ②.



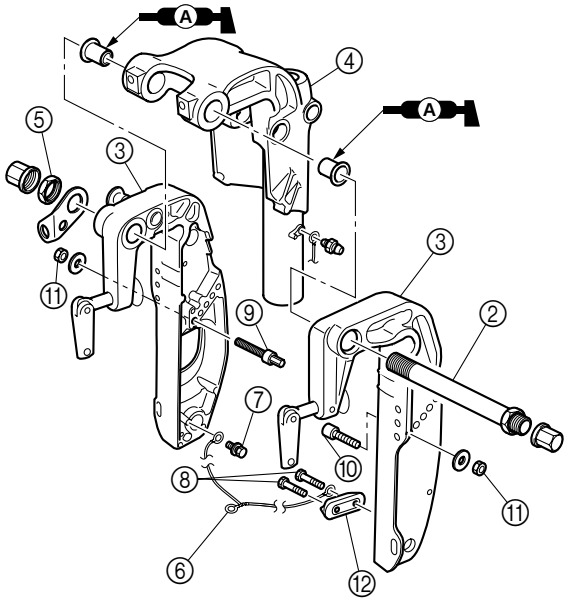
S6AG7800

2. Assemble the clamp brackets ③ and swivel bracket ④, and then install the through tube ② from the port side.

3. Install the self-locking nut ⑤ onto the through tube ②, and then tighten it to the specified torque.

4. Install the ground lead terminals ⑥ to the brackets using the bolt ⑦ and bolts ⑧.

5. Install stopper 1 ⑨, stopper 2 ⑩, and the stopper nuts ⑪.



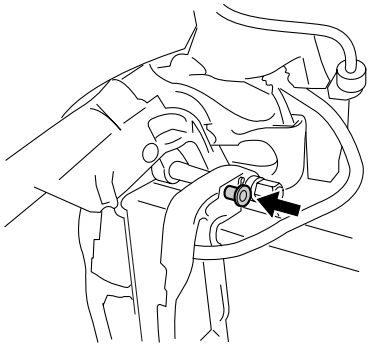
S6AU7055

NOTE:
Install the anode ⑫ with the projection facing towards the bow.

	Self-locking nut ⑤: 19 N·m (1.9 kgf·m, 14.0 ft·lb) Ground lead bolt ⑦: 8 N·m (0.8 kgf·m, 5.9 ft·lb) Anode bolt ⑧: 8 N·m (0.8 kgf·m, 5.9 ft·lb) Stopper nut ⑪: 24 N·m (2.4 kgf·m, 17.7 ft·lb)

Installing the PT unit

1. Fully tilt the outboard motor up, and then support it with the tilt stop lever.



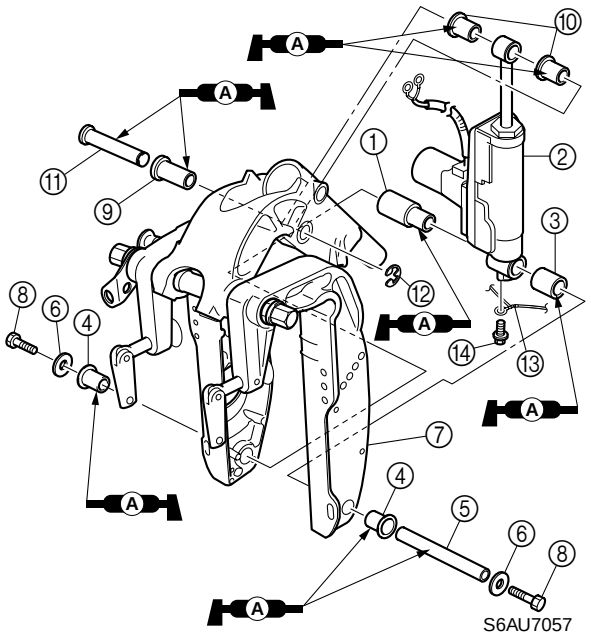
S6AU7056

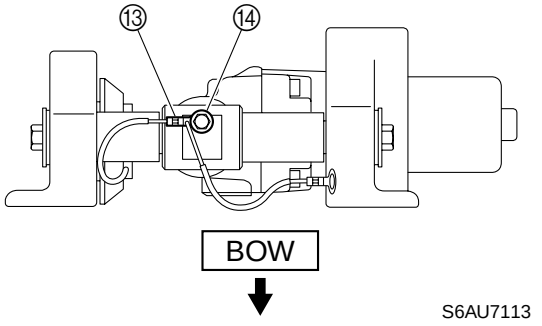
⚠ WARNING

After tilting the outboard motor up, be sure to support it with the tilt stop lever.

7

2. Install the collar ① onto the PT unit ②.
3. Install the PT unit ②, collars ③ and ④, shaft ⑤, and washers ⑥ onto the clamp brackets ⑦, and then tighten the bolts ⑧ to the specified torque.
4. Install the collars ⑨ and ⑩, upper end of the tilt ram, shaft ⑪, and E-clip ⑫ to the swivel bracket.
5. Install the ground lead terminal ⑬ to the PT unit ②.

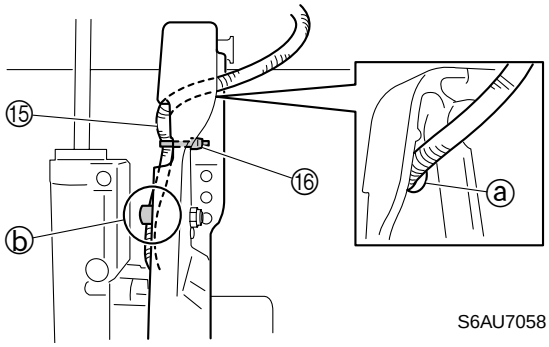




NOTE:
Install the ground lead ⑬ as shown.

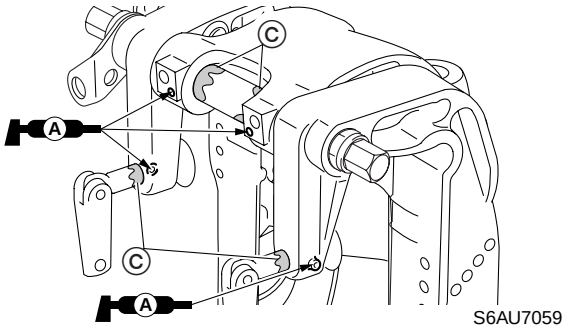
	PT unit mounting shaft bolt ⑧: 18 N·m (1.8 kgf·m, 13.3 ft·lb) Ground lead bolt ⑭: 8 N·m (0.8 kgf·m, 5.9 ft·lb)

6. Pass the PT motor lead ⑮ through the hole ⓐ in the clamp bracket (STBD).
7. Fasten the PT motor lead ⑮ to the clamp bracket with a plastic tie ⑯.

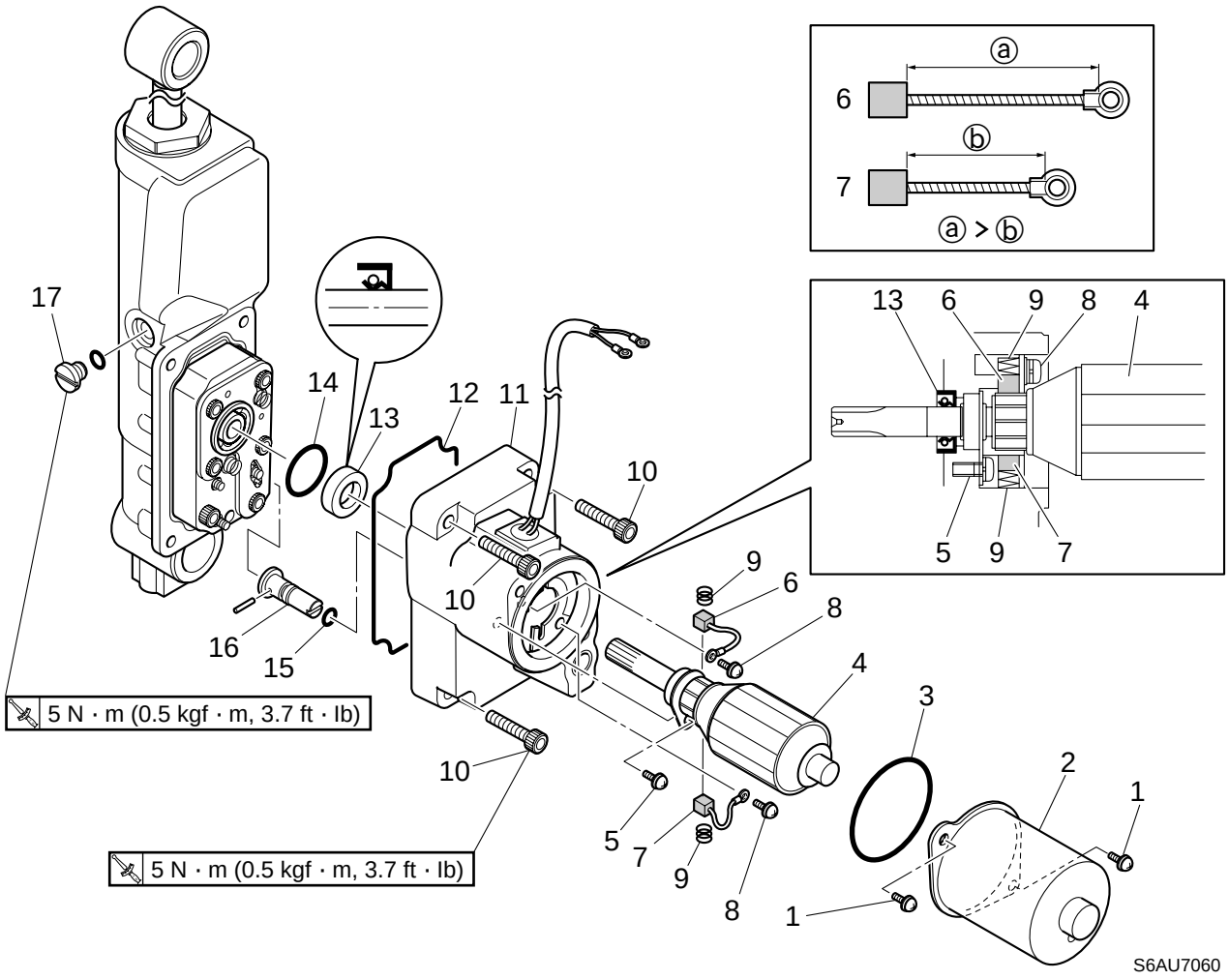


NOTE:
Route the PT motor lead ⑮ to the front of stopper 1 ⓑ.

8. Apply grease to all grease nipples until it comes out from the areas ⓒ.



PT motor



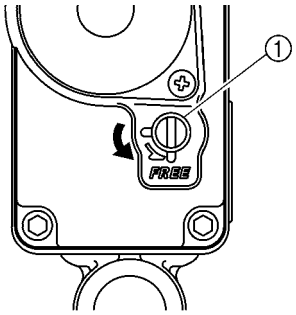
No.	Part name	Q'ty	Remarks
1	Screw	2	ø4 × 10 mm
2	Stator	1	
3	O-ring	1	**Not reusable**
4	Armature	1	
5	Screw	1	ø4 × 8 mm
6	Brush	1	Long lead
7	Brush	1	Short lead
8	Screw	2	ø4 × 10 mm
9	Brush spring	2	
10	Bolt	4	M5 × 25 mm
11	PT motor base	1	
12	Gasket	1	**Not reusable**
13	Oil seal	1	**Not reusable**
14	O-ring	1	**Not reusable**
15	O-ring	1	**Not reusable**
16	Manual valve	1	
17	Reservoir cap	1	

Disassembling the PT motor

1. Remove the PT unit from the bracket.

NOTE:
To remove the PT unit, see “Removing the PT unit” (7-33).

2. Fully extend the tilt ram, and then open the manual valve ① by turning it counterclockwise.



S6AG7335

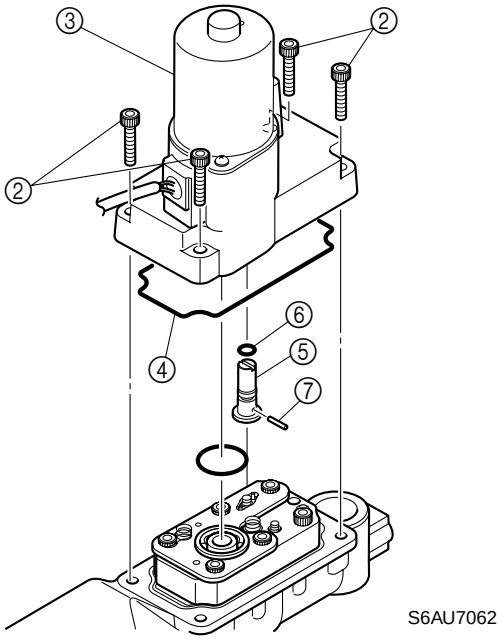
⚠ WARNING

Make sure that the tilt ram is fully extended before removing the PT motor, otherwise fluid can spurt out from the unit due to internal pressure.

NOTE:
To prevent the internal PT unit parts from falling out, lay the PT unit on its side so that the PT motor is in an upright position before removing it.

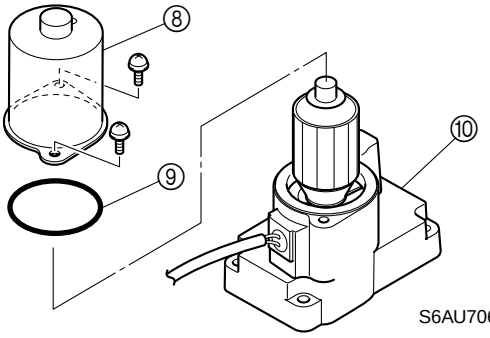
3. Remove the PT motor base bolts ②, and then remove the PT motor assembly ③ and gasket ④ from the tilt cylinder.

4. Remove the manual valve ⑤, O-ring ⑥, and pin ⑦.



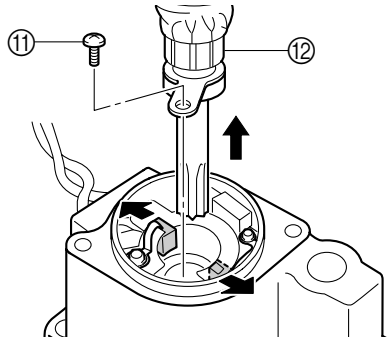
S6AU7062

5. Remove the stator ⑧ and O-ring ⑨ from the PT motor base ⑩.



S6AU7063

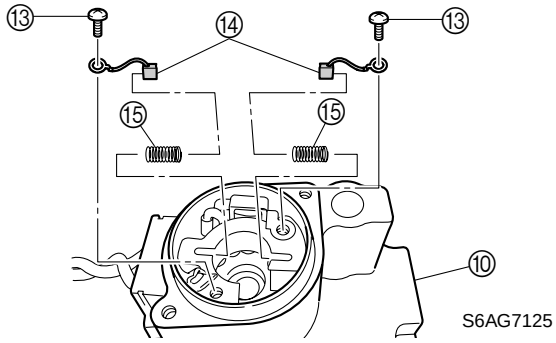
6. Remove the armature plate screw ⑪, and then remove the armature assembly ⑫.



S6AU7064

NOTE:
- Push the brushes apart, and then remove the armature assembly.
- Do not remove the bearing from the armature assembly.

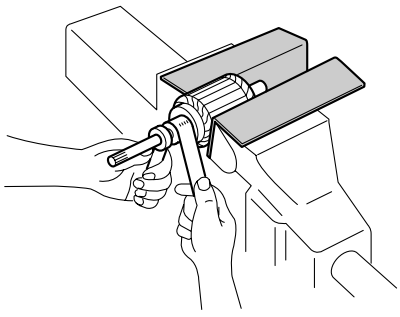
7. Remove the brush holder screws ⑬, brushes ⑭, brush springs ⑮, and oil seal from the PT motor base ⑩.



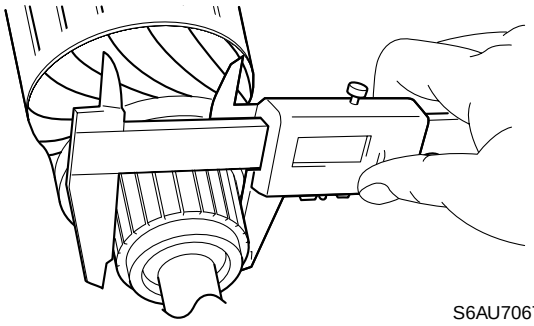
S6AG7125

Checking the PT motor

1. Check the commutator. Clean with 600-grit sandpaper and compressed air if dirty.

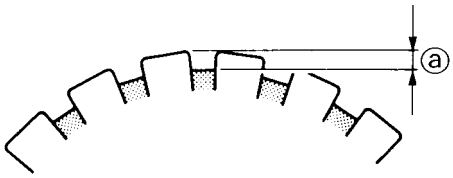

S6AU7066

2. Measure the commutator diameter. Replace the armature if below specification.


S6AU7067

Motor commutator standard diameter: 16.5 mm (0.65 in) Wear limit: 15.5 mm (0.61 in)	

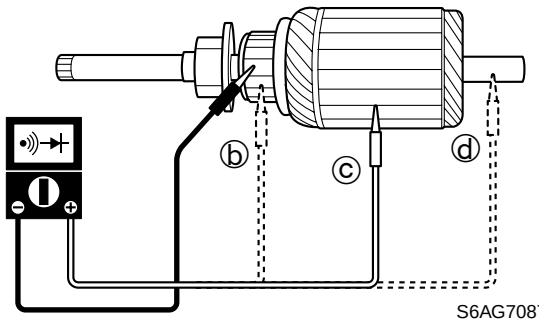
3. Measure the commutator undercut ⓐ. Replace the armature if below specification.



S69J8410

Motor commutator standard undercut ⓐ: 1.00 mm (0.039 in) Wear limit: 0.50 mm (0.020 in)	

4. Check the armature for continuity. Replace the armature if out of specification.



S6AG7087

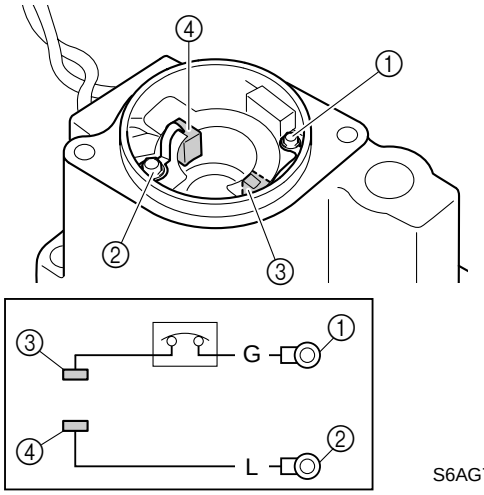
Armature continuity

Checking point	Continuity
Commutator segments ⓑ	Yes
Segment – Armature core ⓒ	No
Segment – Armature shaft ⓓ	No

5. Check the bearing. Replace the armature if damaged.

Checking the brush holder and brush

1. Check the brush holder assembly for continuity. Replace the PT motor base if out of specification.



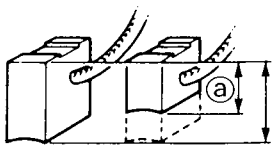
S6AG7090

NOTE:
The brush holder and circuit breaker cannot be removed from the PT motor base assembly; if either part is damaged, replace the PT motor base.

PT motor base continuity

Checking point	Continuity
Terminal ① – ③ (G) Terminal ② – ④ (L)	Yes
For all terminal combinations not listed above.	No

2. Measure the length of each brush. Replace the brushes if below specification.



S69J8430

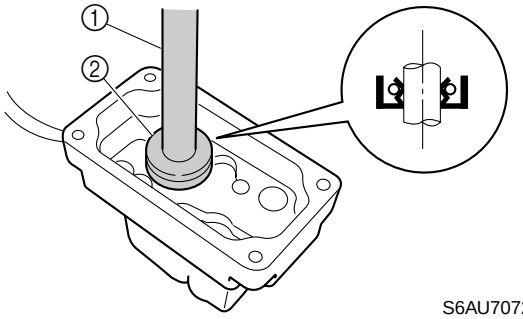
Motor brush standard length:
6.0 mm (0.24 in)
Wear limit ⓐ: 3.0 mm (0.12 in)

Assembling the PT motor

CAUTION:

- **Do not reuse the oil seal and O-ring, always replace them with new ones.**
- **Do not allow grease or oil to contact the commutator of the armature.**

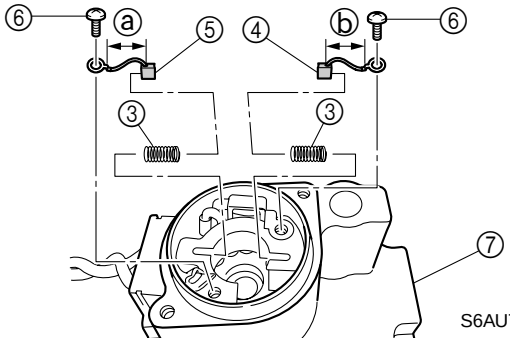
1. Install a new oil seal into the PT motor base as shown.



S6AU7072

Driver rod L3 ①: 90890-06652
Needle bearing attachment ②: 90890-06615

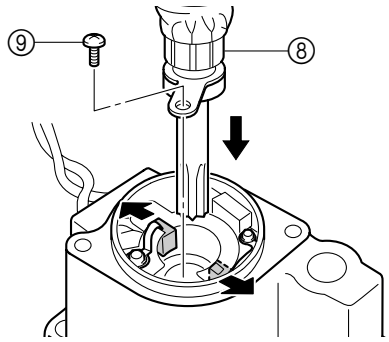
2. Install the brush springs ③, brush (short lead) ④, brush (long lead) ⑤, and brush holder screws ⑥ to the PT motor base ⑦ as shown.



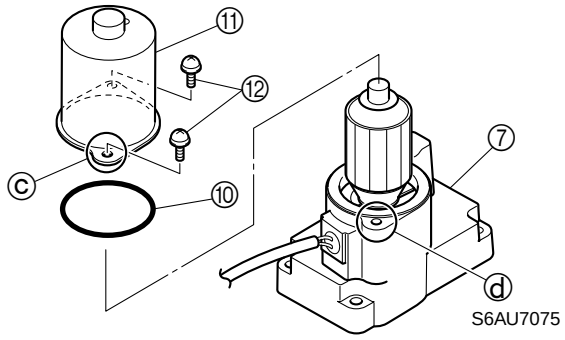
S6AU7073

Brush lead length: ⓐ > ⓑ

3. Push the brushes into the holders, and then install the armature assembly ⑧ and tighten the armature plate screw ⑨.



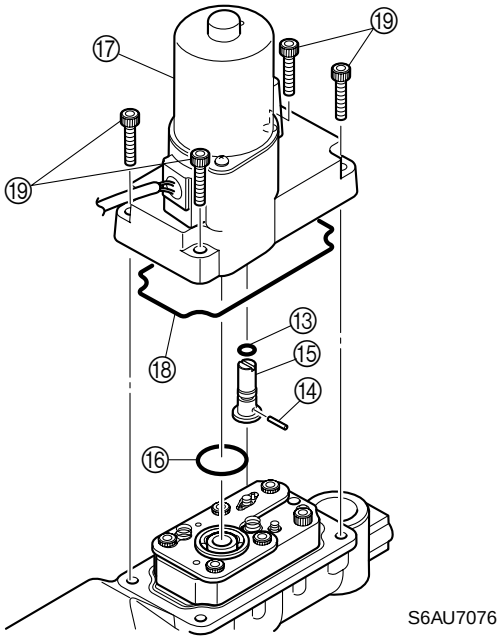
4. Install a new O-ring ⑩ and the stator ⑪ to the PT motor base ⑦, and then tighten the screws ⑫.



NOTE:
Align the rounded section ⓒ of the stator ⑪ with the rounded section ⓓ of the PT motor base ⑦.

5. Install a new O-ring ⑬, the pin ⑭, the manual valve ⑮, and a new O-ring ⑯ to the PT motor assembly ⑰.

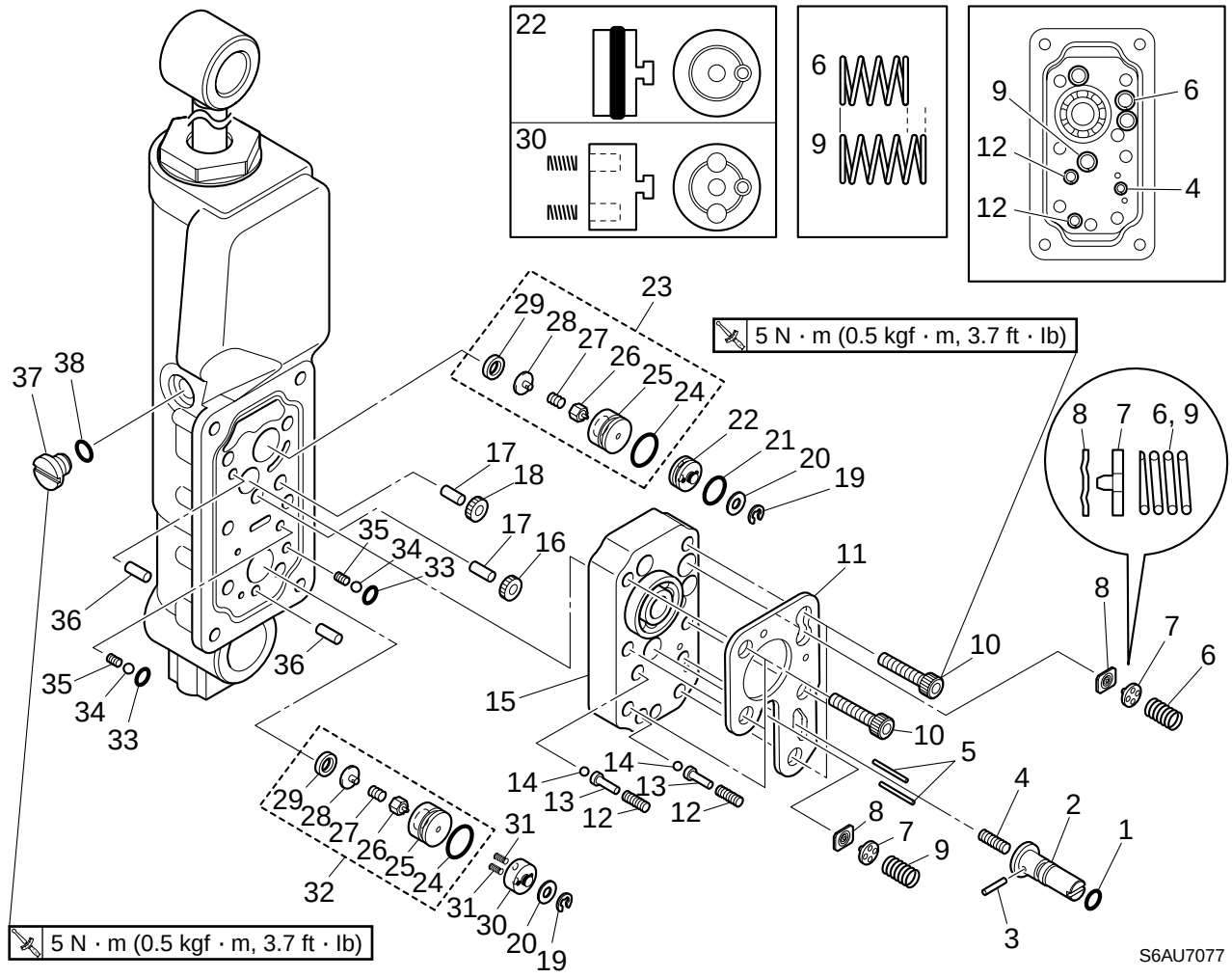
6. Install a new gasket ⑱ and the PT motor assembly ⑰ to the tilt cylinder, and then tighten the PT motor assembly bolts ⑲ to the specified torque.



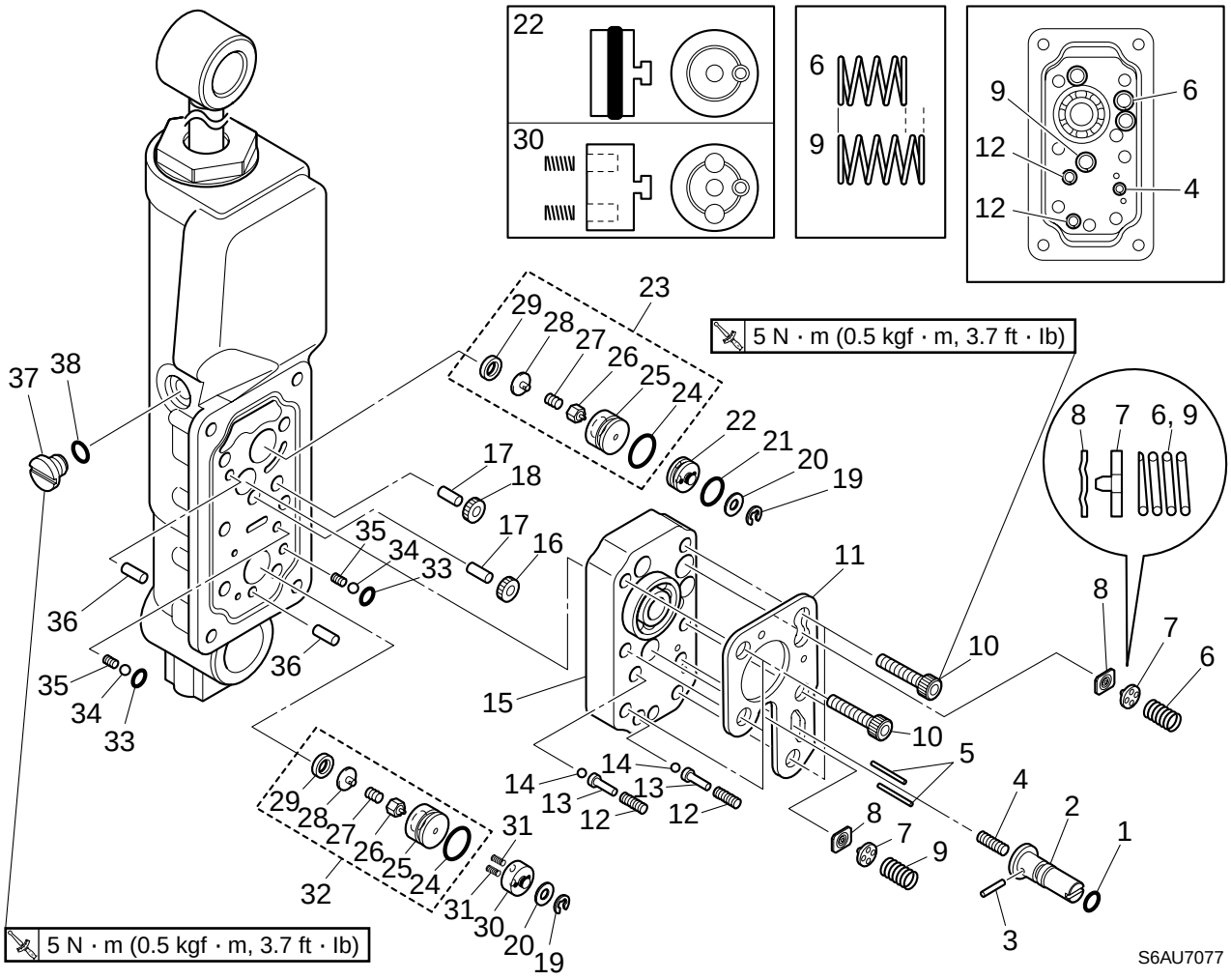
PT motor assembly bolt ⑲:
5 N·m (0.5 kgf·m, 3.7 ft·lb)

7

PT gear pump

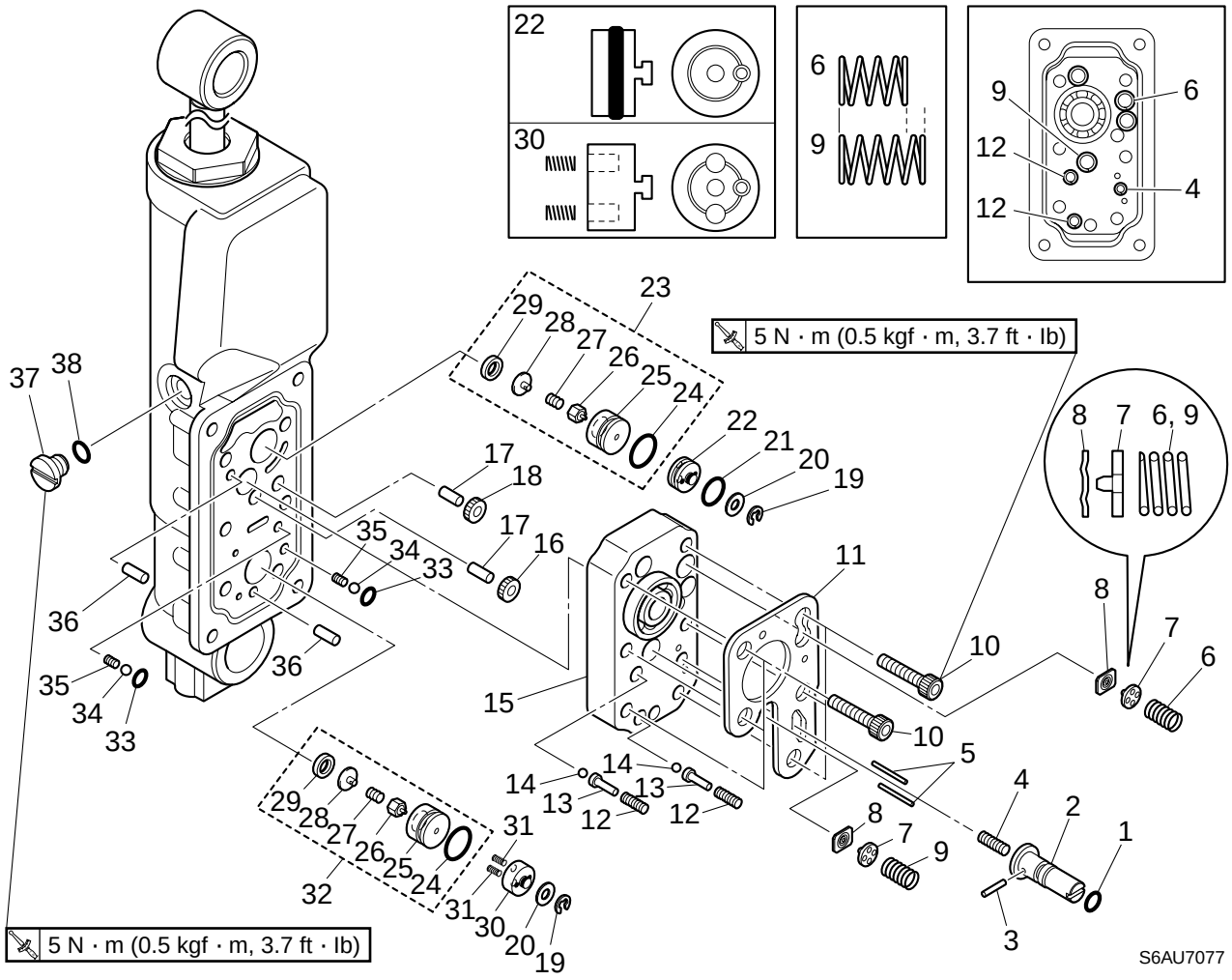


No.	Part name	Q'ty	Remarks
1	O-ring	1	**Not reusable**
2	Manual valve	1	
3	Pin	1	
4	Spring	1	
5	Manual release pin	2	
6	Spring	1	Length: 14.6 mm (0.57 in)
7	Valve pin	2	
8	Valve seal	2	
9	Spring	1	Length: 18.3 mm (0.72 in)
10	Bolt	6	M5 × 25 mm
11	Filter	1	
12	Spring	2	
13	Absorber valve pin	2	
14	Ball	2	
15	Gear pump housing	1	
16	Drive gear	1	
17	Pin	2	



No.	Part name	Q'ty	Remarks
18	Driven gear	1	
19	E-clip	2	
20	Main valve seal	2	
21	O-ring	1	**Not reusable**
22	Shuttle piston 1	1	
23	Down-main valve	1	
24	O-ring	2	**Not reusable**
25	Valve seat	2	
26	Main valve	2	
27	Spring	2	
28	Spacer	2	
29	Filter	2	
30	Shuttle piston 2	1	
31	Spring	2	
32	Up-main valve	1	
33	O-ring	2	**Not reusable**
34	Ball	2	

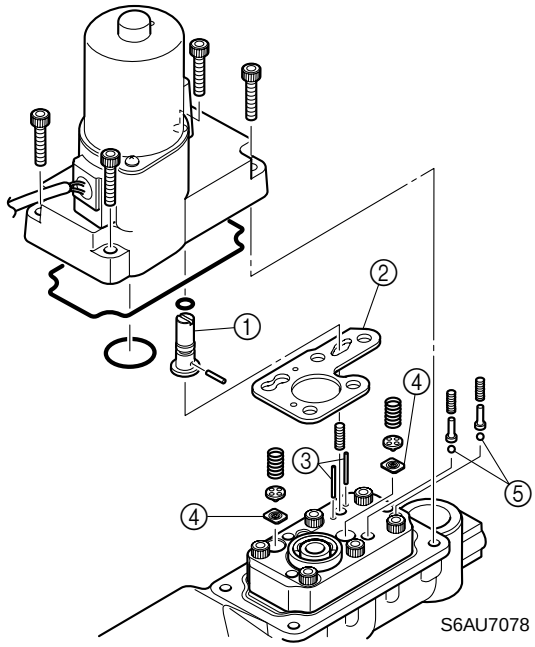
7



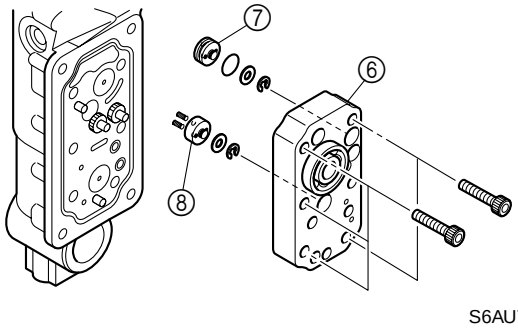
No.	Part name	Q'ty	Remarks
35	Spring	2	
36	Dowel	2	
37	Reservoir cap	1	
38	O-ring	1	**Not reusable**

Disassembling the gear pump

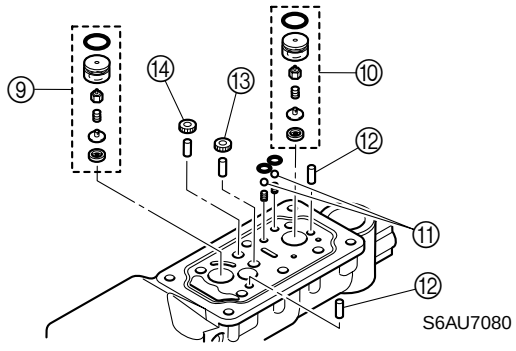
1. Remove the manual valve ①, filter ② manual release pins ③, valve seals ④, and balls ⑤.



2. Remove the gear pump housing ⑥, shuttle piston 1 ⑦ and shuttle piston 2 ⑧.



3. Remove the down-main valve ⑨, up-main valve ⑩, balls ⑪, dowels ⑫, drive gear ⑬, and driven gear ⑭.



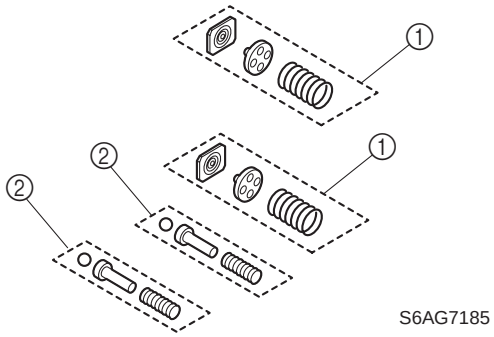
Checking the gear pump

1. Check the drive gear and driven gear. Replace if damaged or excessively worn.

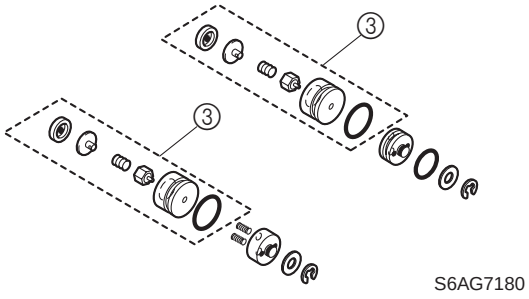
2. Check the gear pump housing. Replace if scratched.

Checking the valve seal

1. Check the valve seals ① and absorber valve pins ②. Replace if damaged.



2. Check the main valves ③. Replace if damaged.



3. Check the manual valve and spring. Replace if damaged.

Checking the filter

1. Check the gear pump filters. Clean if there is dirt or residue.

NOTE:
See the exploded diagram for the filter installation positions (7-41).

Assembling the gear pump

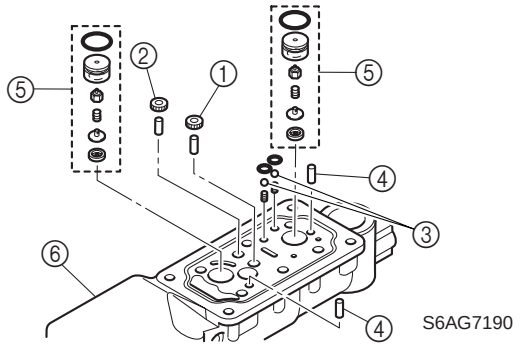
CAUTION:

- **Do not use a rag when assembling the PT unit as dust and particles on the PT unit components can lead to poor performance.**
- **Do not reuse the O-rings, always replace them with new ones.**

NOTE:

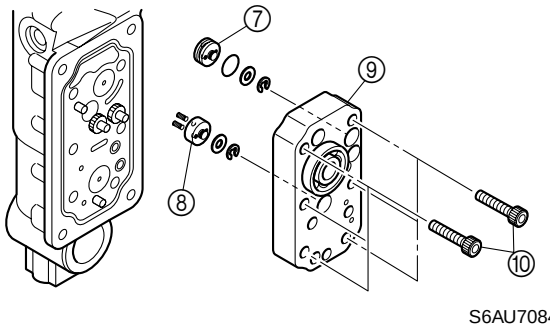
Lubricate the parts with ATF Dexron II during assembly.

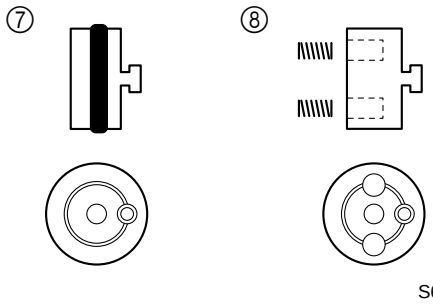
1. Install the drive gear ①, driven gear ②, balls ③, dowels ④, and main valves ⑤ to the tilt cylinder ⑥.



2. Install shuttle piston 1 ⑦ and shuttle piston 2 ⑧ to the gear pump housing ⑨, and then install the housing to the tilt cylinder.

3. Install the gear housing bolts ⑩, and then tighten the bolts to the specified torque.



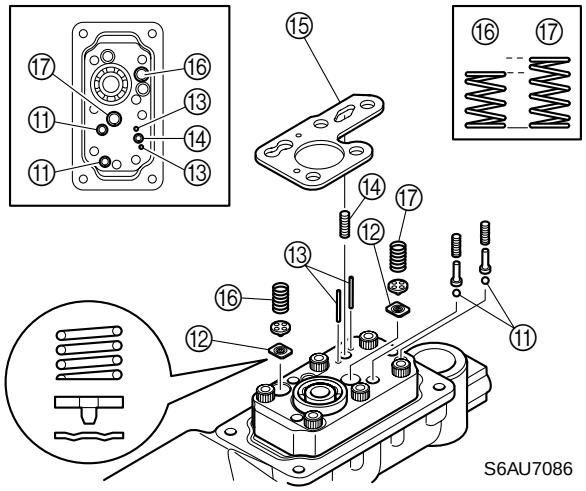


NOTE:

Be sure to install shuttle piston 1 ⑦ and shuttle piston 2 ⑧ in the correct positions; the piston shapes are different.

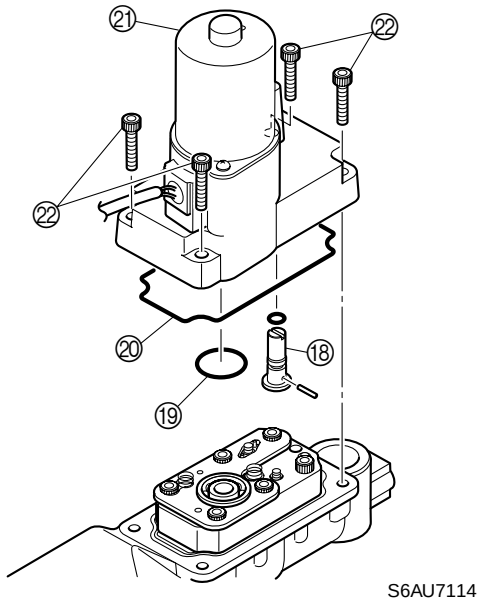
Gear housing bolt ⑩:
5 N·m (0.5 kgf·m, 3.7 ft·lb)

4. Install the balls ⑪, valve seals ⑫, manual release pins ⑬, spring ⑭, and filter ⑮ to the gear pump housing.



5. Install the manual valve ⑱ and a new O-ring ⑲ to the PT motor base.

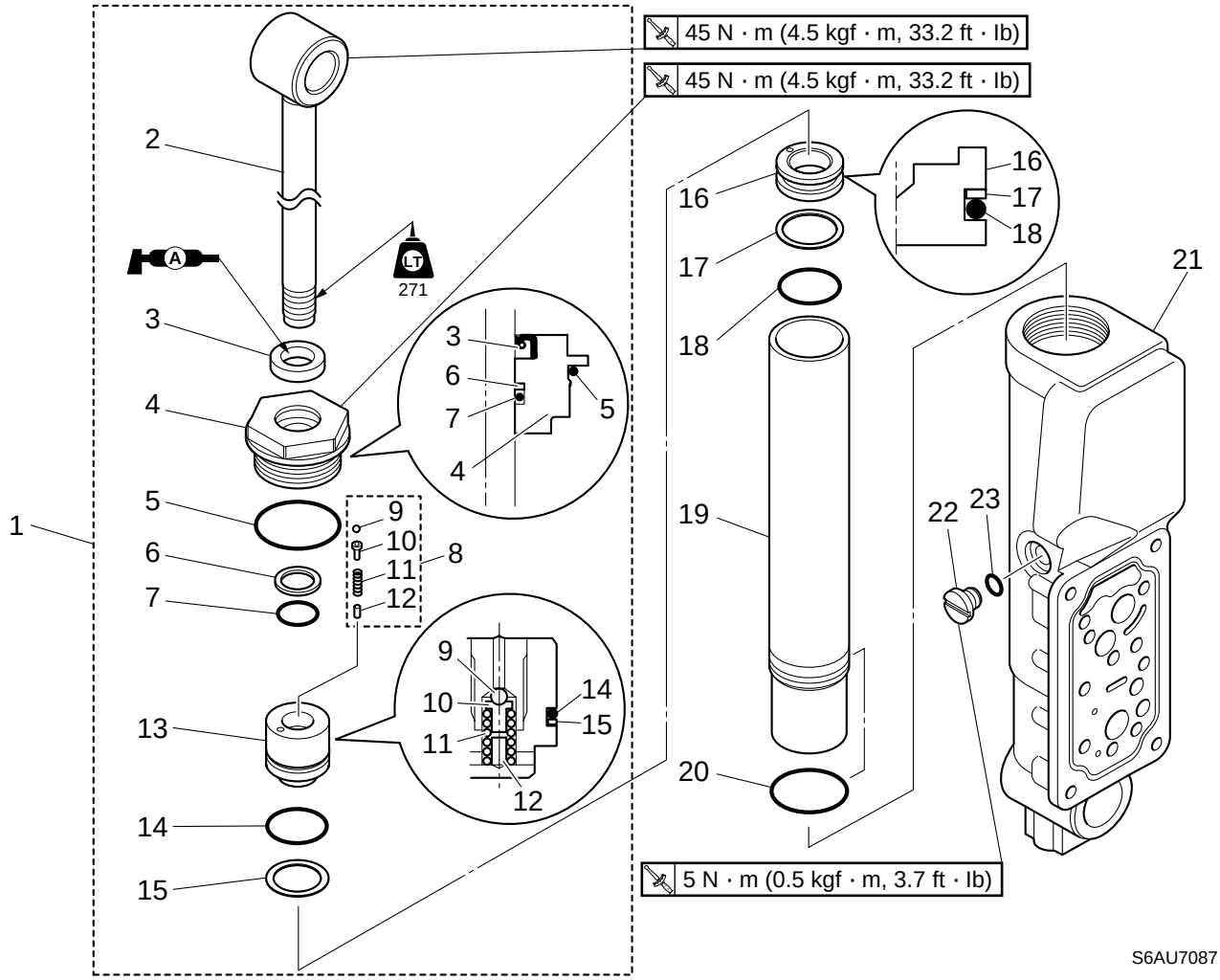
6. Install a new gasket ⑳ and the PT motor assembly ㉑ to the tilt cylinder, and then tighten the PT motor assembly bolts ㉒ to the specified torque.



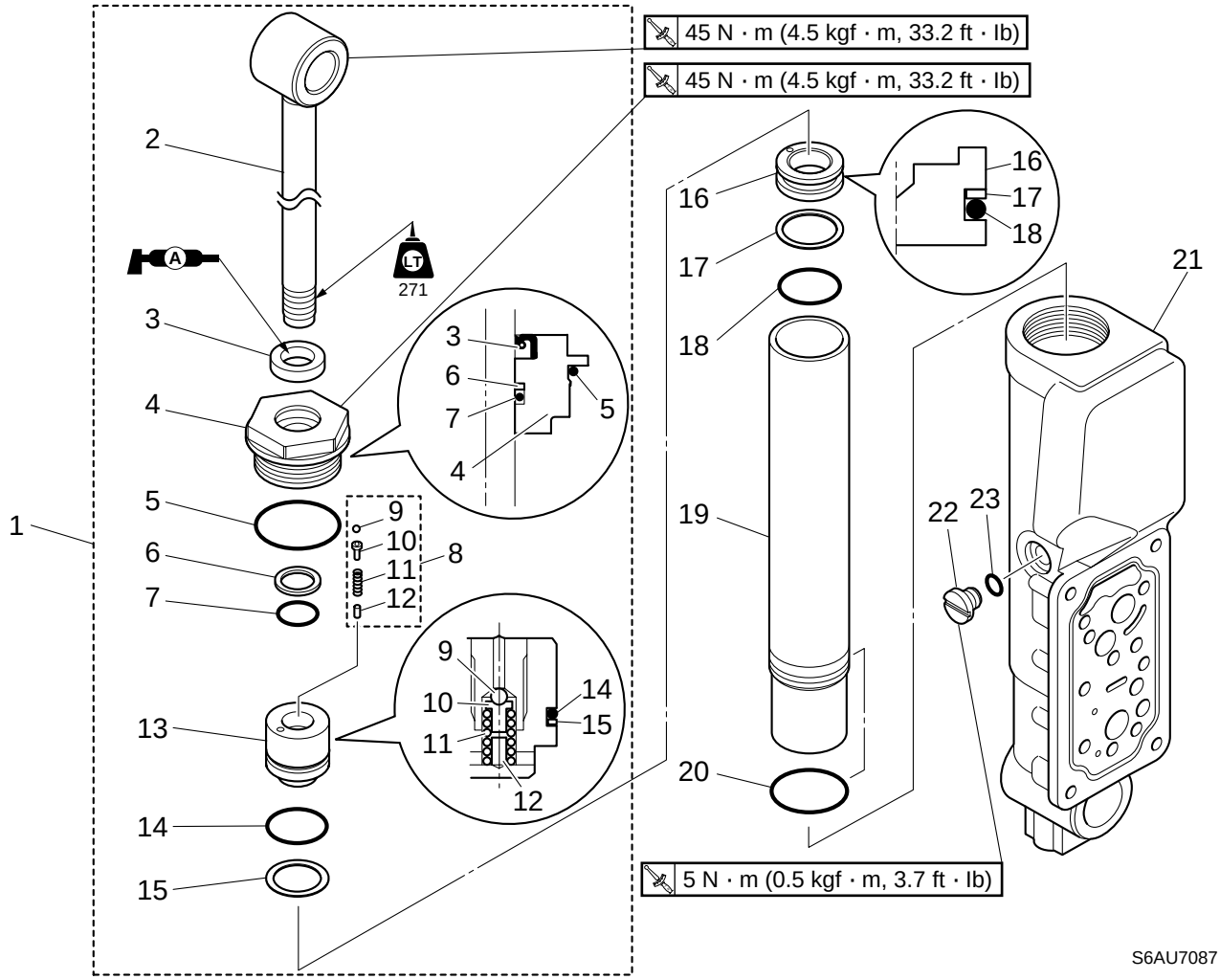
S6AU7114

	PT motor assembly bolt ㉒: 5 N·m (0.5 kgf·m, 3.7 ft·lb)

PT cylinder



No.	Part name	Q'ty	Remarks
1	Tilt ram assembly	1	
2	Tilt ram	1	
3	Dust seal	1	**Not reusable**
4	Tilt cylinder end screw	1	
5	O-ring	1	**Not reusable**
6	Backup ring	1	
7	O-ring	1	**Not reusable**
8	Absorber valve	1	
9	Ball	1	
10	Pin	1	
11	Spring	1	
12	Dowel	1	
13	Tilt piston	1	
14	O-ring	1	**Not reusable**
15	Backup ring	1	
16	Free piston	1	
17	Backup ring	1	

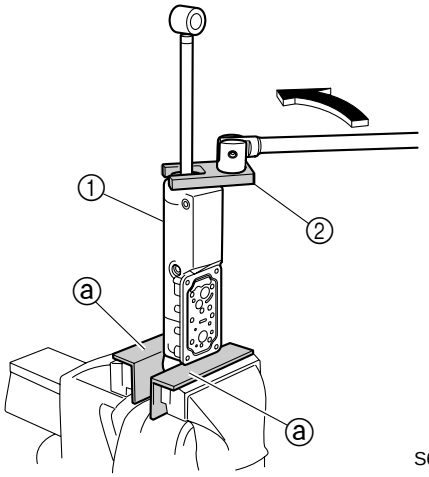


No.	Part name	Q'ty	Remarks
18	O-ring	1	**Not reusable**
19	Tilt cylinder	1	
20	O-ring	1	**Not reusable**
21	Cylinder	1	
22	Reservoir cap	1	
23	O-ring	1	**Not reusable**

Disassembling the tilt cylinder

1. Hold the cylinder ① in a vise using aluminum plates ⓐ on both sides.

2. Loosen the tilt cylinder end screw, and then remove the tilt ram assembly.



S6AG7215

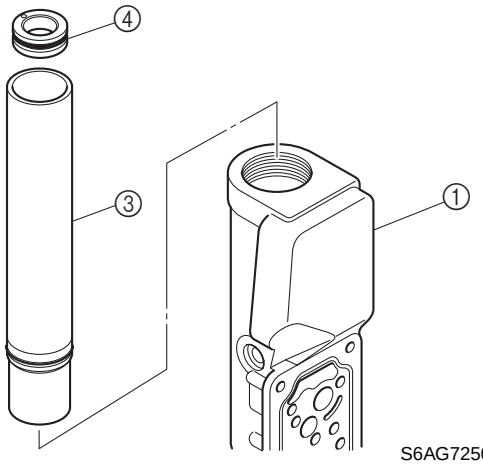
⚠ WARNING

Make sure that the ram is fully extended before removing the end screw.

Power tilt wrench ②: 90890-06560

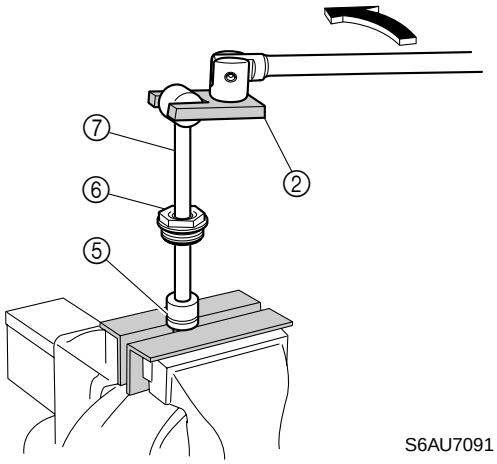
3. Drain the PT fluid.

4. Remove the tilt cylinder ③ and free piston ④ from the cylinder ①.



S6AG7250

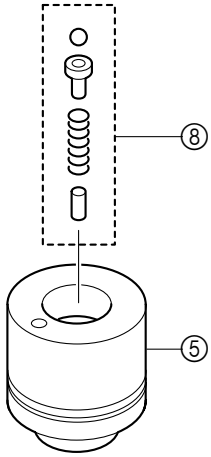
5. Hold the tilt piston ⑤ in a vise using aluminum plates on both sides, and then remove the tilt piston ⑤ and tilt cylinder end screw ⑥ from the tilt ram ⑦.



S6AU7091

Power tilt wrench ②: 90890-06560

6. Remove the absorber valve ⑧ from the tilt piston ⑤.



S6AU7090

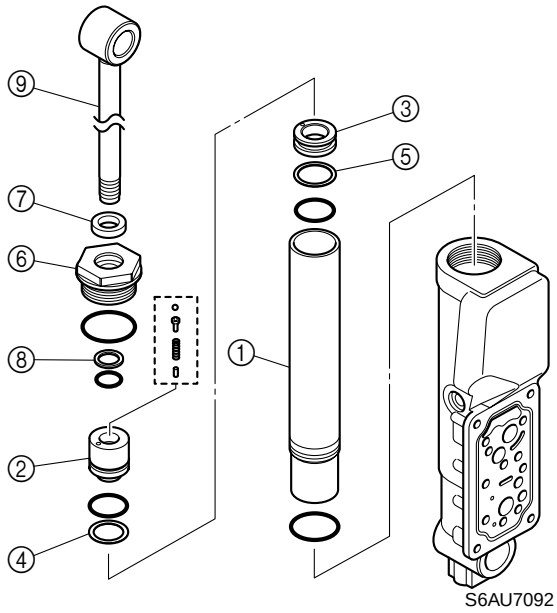
Checking the tilt cylinder and piston

1. Check the tilt cylinder ①. Replace if cracked or scratched.

2. Check the tilt piston ②, free piston ③, and backup rings ④ and ⑤. Replace if cracked or scratched.

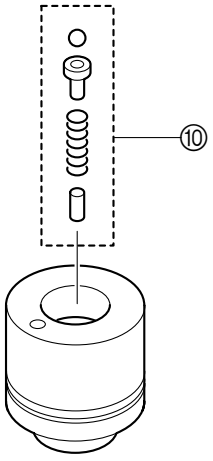
3. Check the tilt cylinder end screw ⑥, dust seal ⑦, and backup ring ⑧. Replace if cracked or scratched.

4. Check the tilt ram ⑨. Polish with 400–600-grit sandpaper if there is light rust or replace if bent or excessively corroded.



S6AU7092

5. Check the absorber valve ⑩. Clean if there is dirt or residue.



S6AU7093

Assembling the tilt cylinder

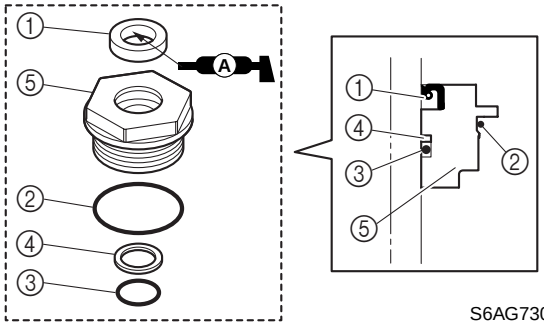
CAUTION:

- **Do not use a rag when assembling the PT unit as dust and particles on the PT unit components can lead to poor performance.**
- **Do not reuse the dust seal and O-rings, always replace them with new ones.**

NOTE:

Lubricate the parts with ATF Dexron II during assembly.

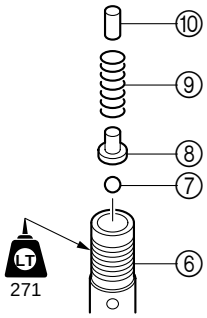
1. Install a new dust seal ①, new O-rings ② and ③, and the backup ring ④ into the tilt cylinder end screw ⑤.



S6AG7300

2. Install the tilt cylinder end screw ⑤ to the tilt ram ⑥.

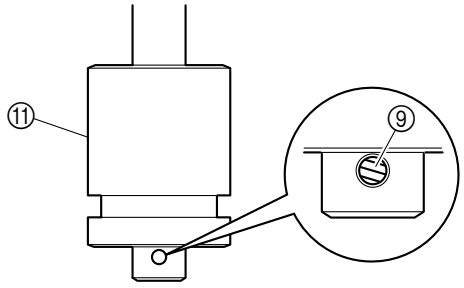
3. Install the ball ⑦, pin ⑧, spring ⑨, and dowel ⑩ to the tilt ram ⑥.



S6AU7116

7

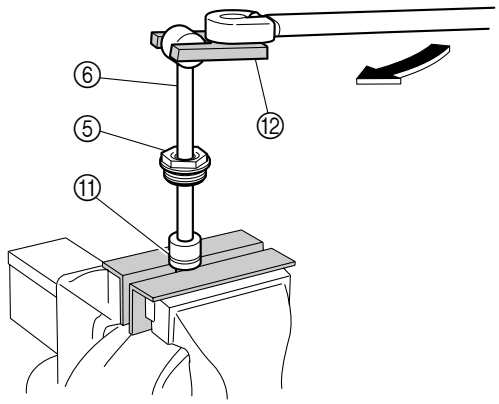
4. Install the tilt piston ⑪.



S6AU7115

NOTE:
Tighten the tilt piston temporarily, and then check that the spring ⑨ is visible through the oil hole in the piston when the tilt ram assembly is upright.

5. Hold the tilt piston ⑪ in a vise using aluminum plates on both sides, and then tighten the tilt ram ⑥ to the specified torque.

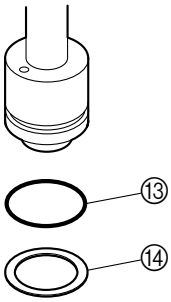


S6AU7095

Power tilt wrench ⑫: 90890-06560

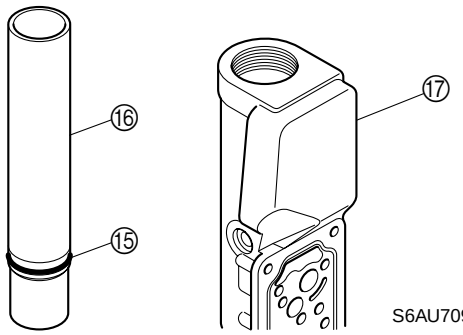
Tilt ram ⑥:
45 N·m (4.5 kgf·m, 33.2 ft·lb)

6. Install a new O-ring ⑬ and the backup ring ⑭ onto the tilt piston.



S6AU7096

7. Install a new O-ring ⑮ to the tilt cylinder ⑯, and then install the tilt cylinder into the cylinder ⑰.



S6AU7097

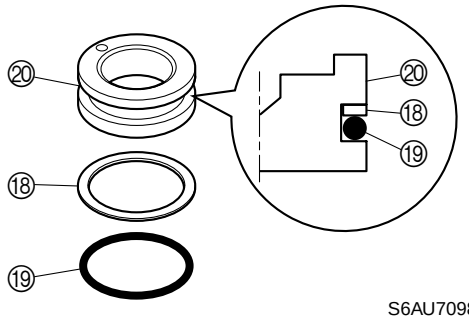
8. Install the PT gear pump, PT motor assembly, and reservoir cap to the tilt cylinder.

NOTE:
To install the PT motor assembly and gear pump assembly, see “Assembling the gear pump” (7-45).

9. Fill the cylinder with the recommended PT fluid to about 60%.

Recommended PT fluid:
ATF Dexron II

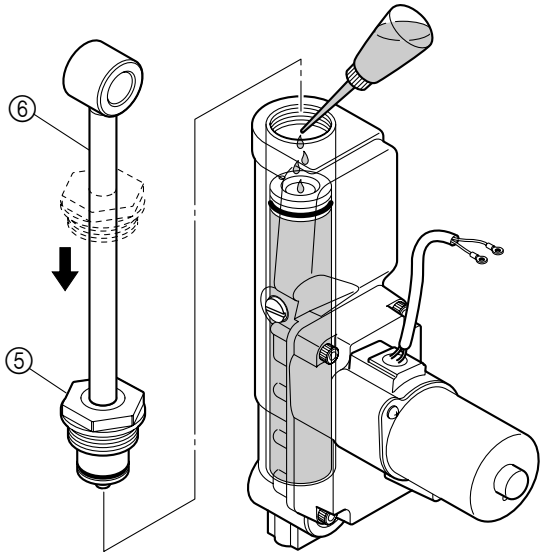
10. Install the backup ring ⑱ and a new O-ring ⑲ to the free piston ⑳, and then install the free piston into the cylinder ⑰.



S6AU7098

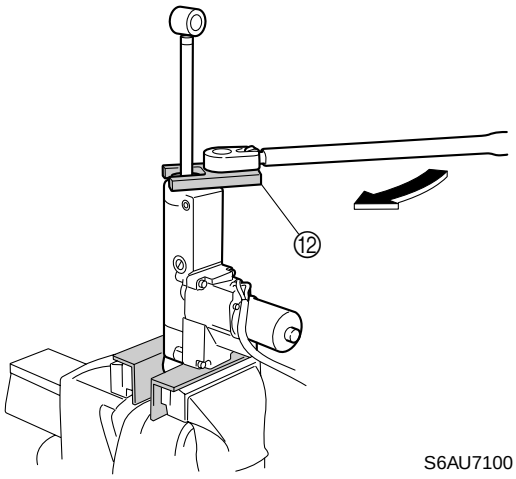
11. Place the tilt cylinder end screw ⑤ at the bottom of the tilt ram ⑥.

12. Install the tilt ram assembly into the cylinder.



S6AU7099

13. Tighten the tilt cylinder end screw to the specified torque.



S6AU7100

	Power tilt wrench ⑫: 90890-06560

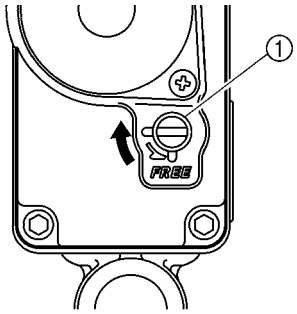
	Tilt cylinder end screw ⑤: 45 N·m (4.5 kgf·m, 33.2 ft·lb)

Bleeding the PT unit

NOTE:
Make sure that the tilt ram is fully extended.

1. Place the PT unit in an upright position.

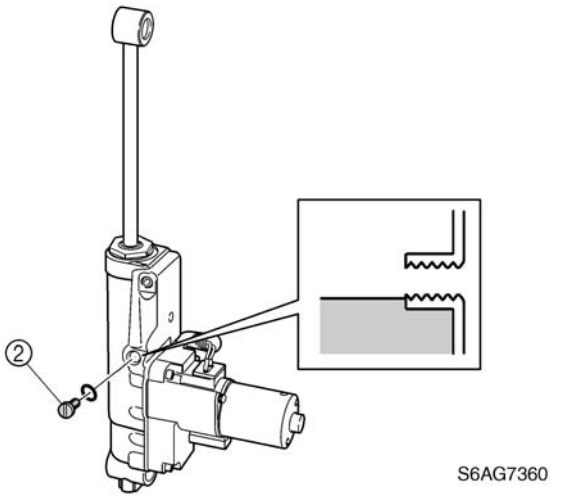
2. Turn the manual valve ① clockwise 90° to close it.



S6AG7341

7

3. Remove the reservoir cap ②, and then check the fluid level in the reservoir.



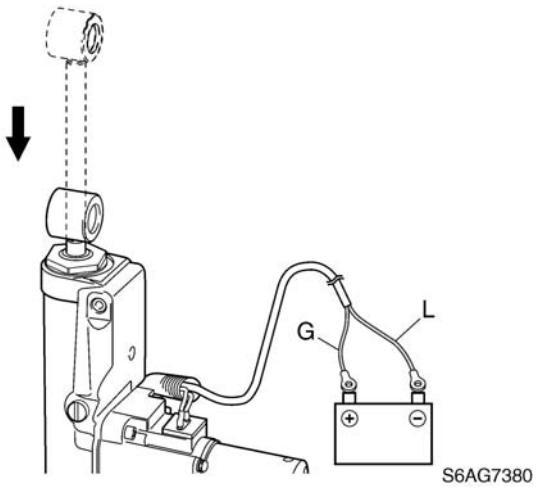
NOTE:
- If the fluid is at the correct level, a small amount of fluid should overflow out of the filler hole.
- If fluid is below the correct level, add the recommended PT fluid.

Recommended PT fluid:
ATF Dexron II

4. Install the reservoir cap ②, and then tighten it to the specified torque.

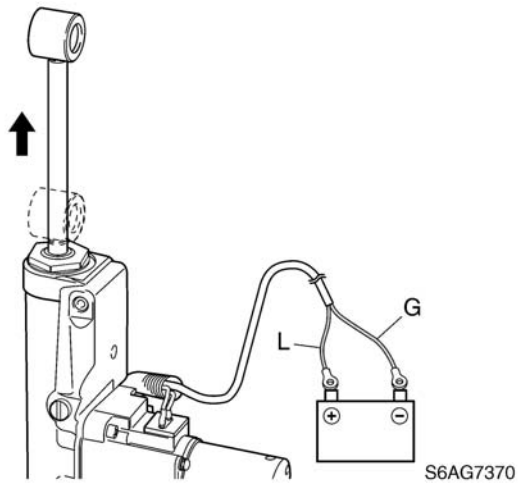
Reservoir cap ②:
5 N·m (0.5 kgf·m, 3.7 ft·lb)

5. Connect the PT motor leads to the battery terminals to fully retract the tilt ram.



Ram	PT motor lead	Battery terminal
Down	Green (G)	⊕
	Blue (L)	⊖

6. Reverse the PT motor leads between the battery terminals to fully extend the tilt ram.



Ram	PT motor lead	Battery terminal
Up	Blue (L)	⊕
	Green (G)	⊖

NOTE:
- Repeat steps 5–6 to fully extend and retract the tilt ram 4 to 5 times.
- If the tilt ram does not move up and down easily, push and pull on the ram to assist the operation.

7. Fully extend the tilt ram.

8. Remove the reservoir cap, and then check the fluid level in the reservoir.

⚠ WARNING

Make sure that the tilt ram is fully extended when removing the reservoir cap, otherwise fluid can spurt out from the unit due to internal pressure.

NOTE:
- If the fluid is at the correct level, a small amount of fluid should overflow out of the filler hole when the cap is removed.
- If the fluid is below the correct level, add the recommended PT fluid.

Recommended PT fluid:
ATF Dexron II

9. Install the reservoir cap, and then tighten it to the specified torque.

NOTE:
If the fluid is below the correct level in step 8, repeat steps 5–9 until the fluid remains at the correct level.

Reservoir cap:
5 N·m (0.5 kgf·m, 3.7 ft·lb)

PT electrical system

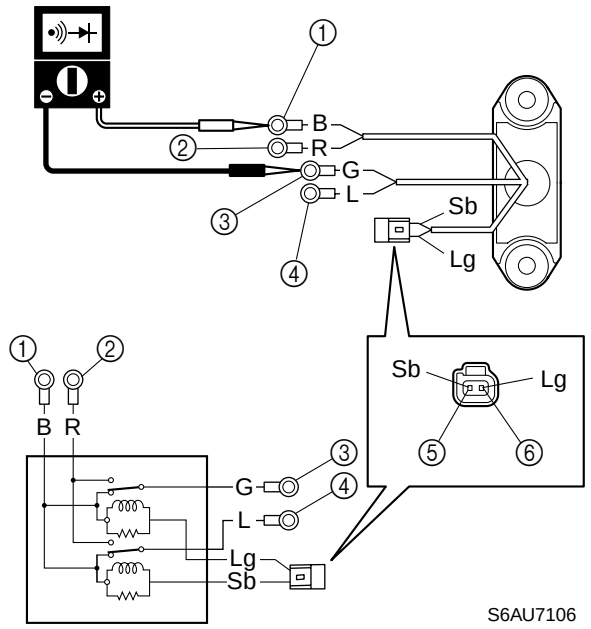
Checking the fuse

1. Check the fuse for continuity. Replace if there is no continuity.

NOTE:
- For the location of the fuse, see “Electrical component and wiring harness routing” (8-1).
- To check the fuse, see “Checking the fuse (E model)” (8-26).

Checking the PT relay

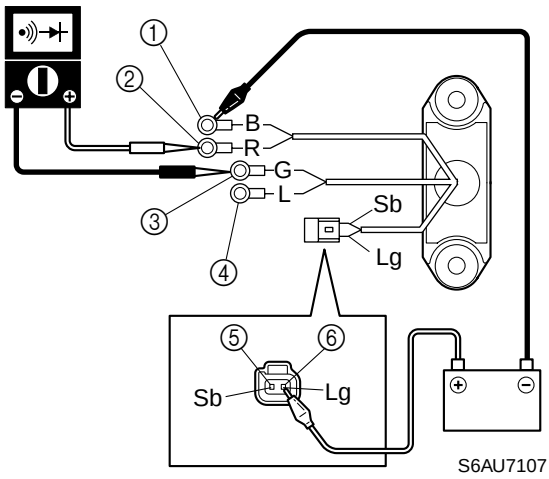
1. Check the PT relay for continuity. Replace if out of specification.



PT relay continuity	
Black (B) ① – Green (G) ③ Black (B) ① – Blue (L) ④ Black (B) ① – Sky blue (Sb) ⑤ Black (B) ① – Light green (Lg) ⑥	Continuity
Red (R) ② – Green (G) ③ Red (R) ② – Blue (L) ④	No continuity

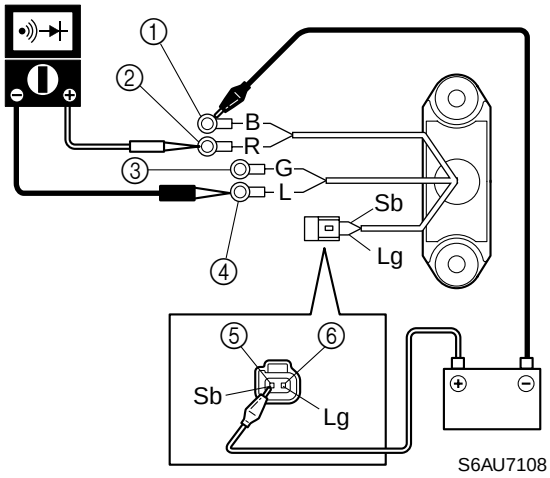
7

2. Connect the positive battery lead to the light green (Lg) lead ⑥, and the negative battery lead to the black (B) terminal ① as shown, and then check the PT relay for continuity. Replace the PT relay if out of specification.



PT relay continuity	
Red (R) ② – Green (G) ③	Continuity
Red (R) ② – Blue (L) ④ Green (G) ③ – Blue (L) ④	No continuity

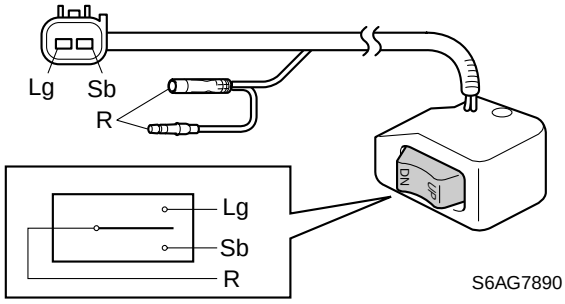
3. Connect the positive battery lead to the sky blue (Sb) lead ⑤, and the negative battery lead to the black (B) terminal ① as shown, and then check the PT relay for continuity. Replace the PT relay if out of specification.



PT relay continuity	
Red (R) ② – Blue (L) ④	Continuity
Red (R) ② – Green (G) ③ Green (G) ③ – Blue (L) ④	No continuity

Checking the PT switch

1. Check the PT switch for continuity. Replace if out of specification.



Switch position	Lead color		
	Sky blue (Sb)	Red (R)	Light green (Lg)
Free			
Up	○	○	
Down		○	○

Electrical system

Electrical component and wiring harness routing 8-1
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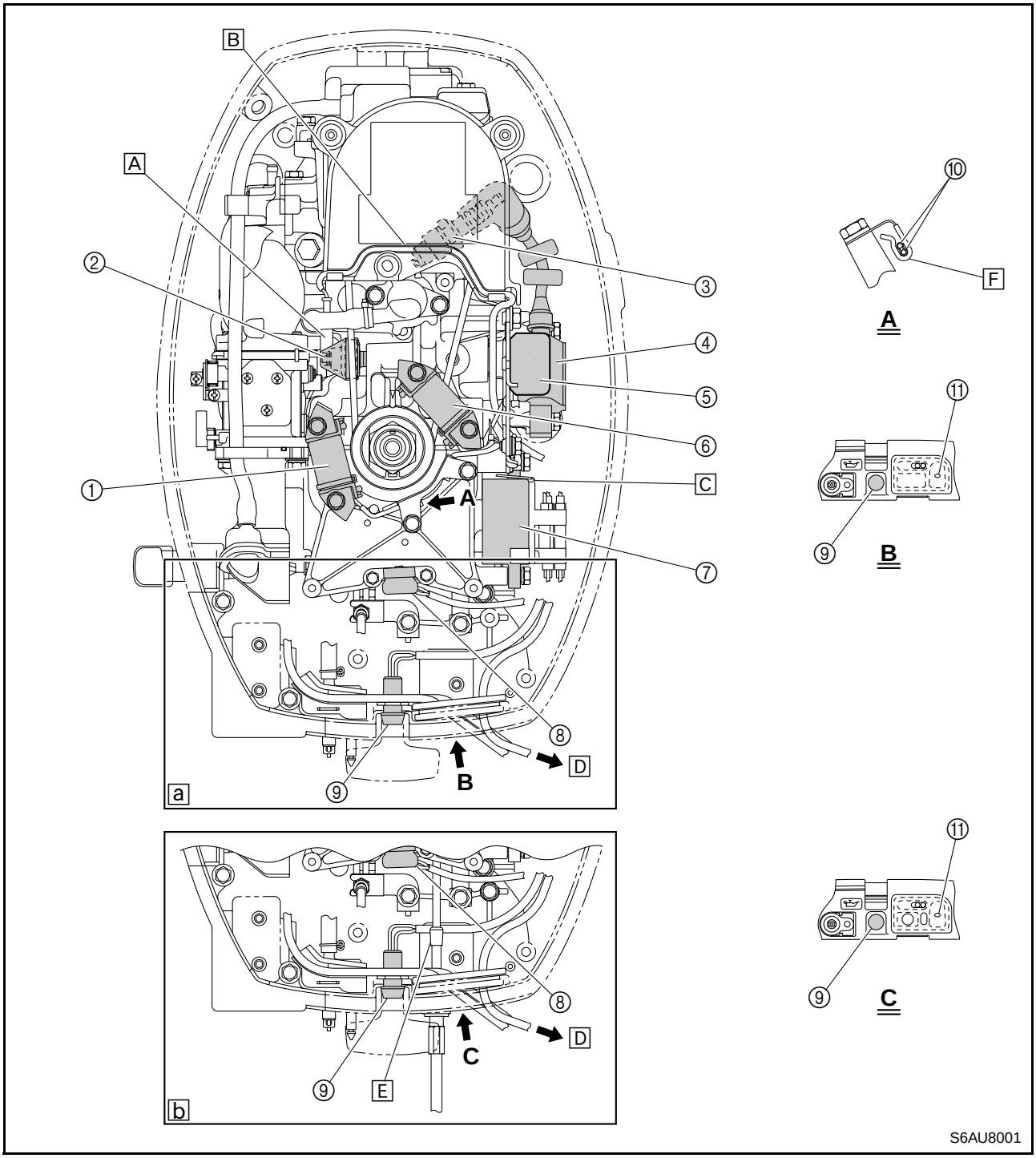
8

Electrical component and wiring harness routing

Top view

H model with 1 lighting coil

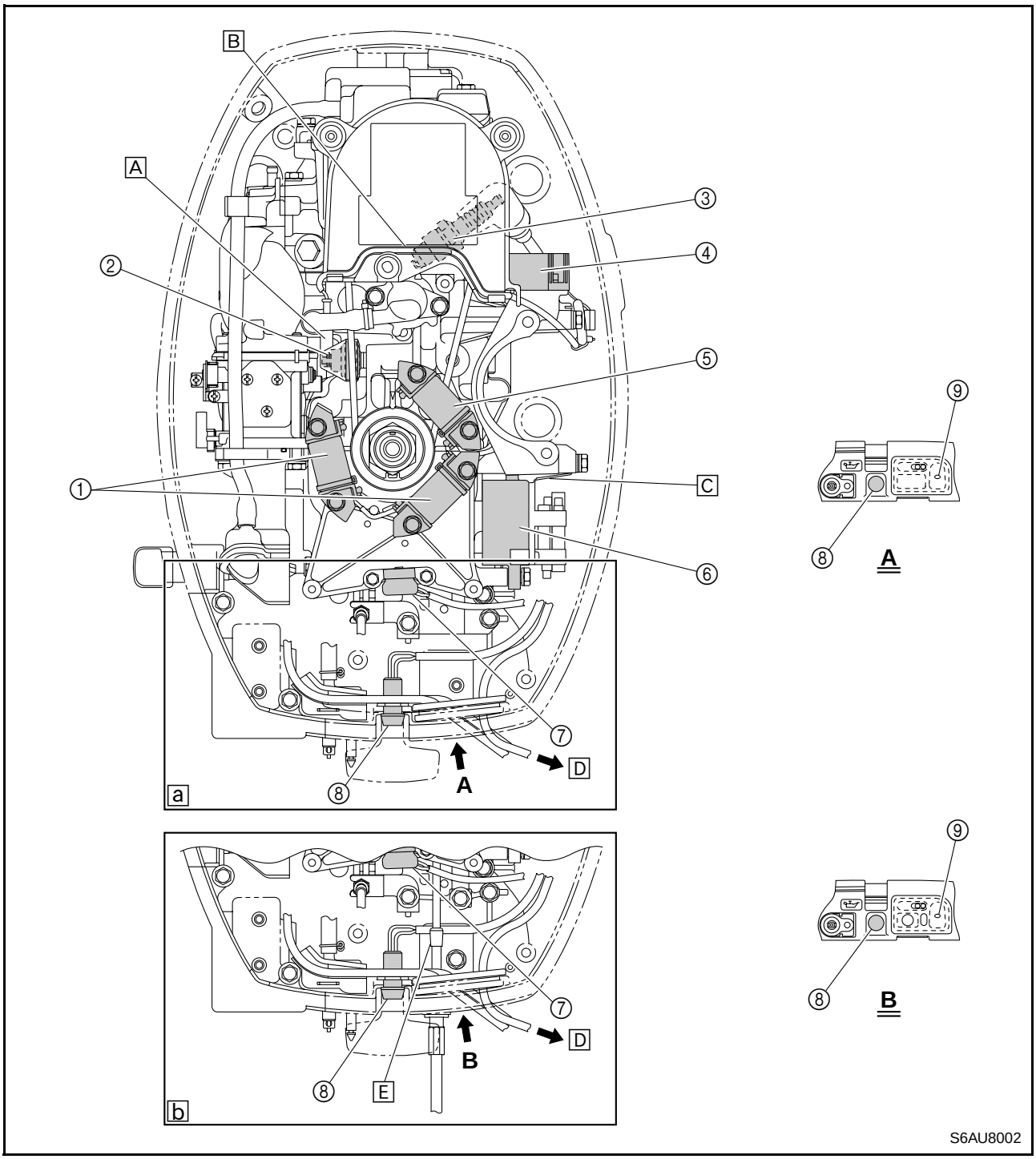


a H model (short)
b H model (long)

① Lighting coil
② Oil pressure switch
③ Spark plug
④ Ignition coil
⑤ Rectifier
⑥ Charge coil
⑦ CDI unit
⑧ Pulser coil
⑨ Warning indicator
⑩ Lighting coil leads (G, G)
⑪ Engine shut-off switch lead

A Route the oil pressure switch lead in the direction shown.
B Fit the oil pressure switch lead into the groove in the driven sprocket cover.
C Bend the side of the junction box inward as shown.
D To tiller handle
E Route the warning indicator lead under the shift cable.
F Fit the lighting coil lead into the holder before installing the lighting coil and holder.

H model with 2 lighting coils

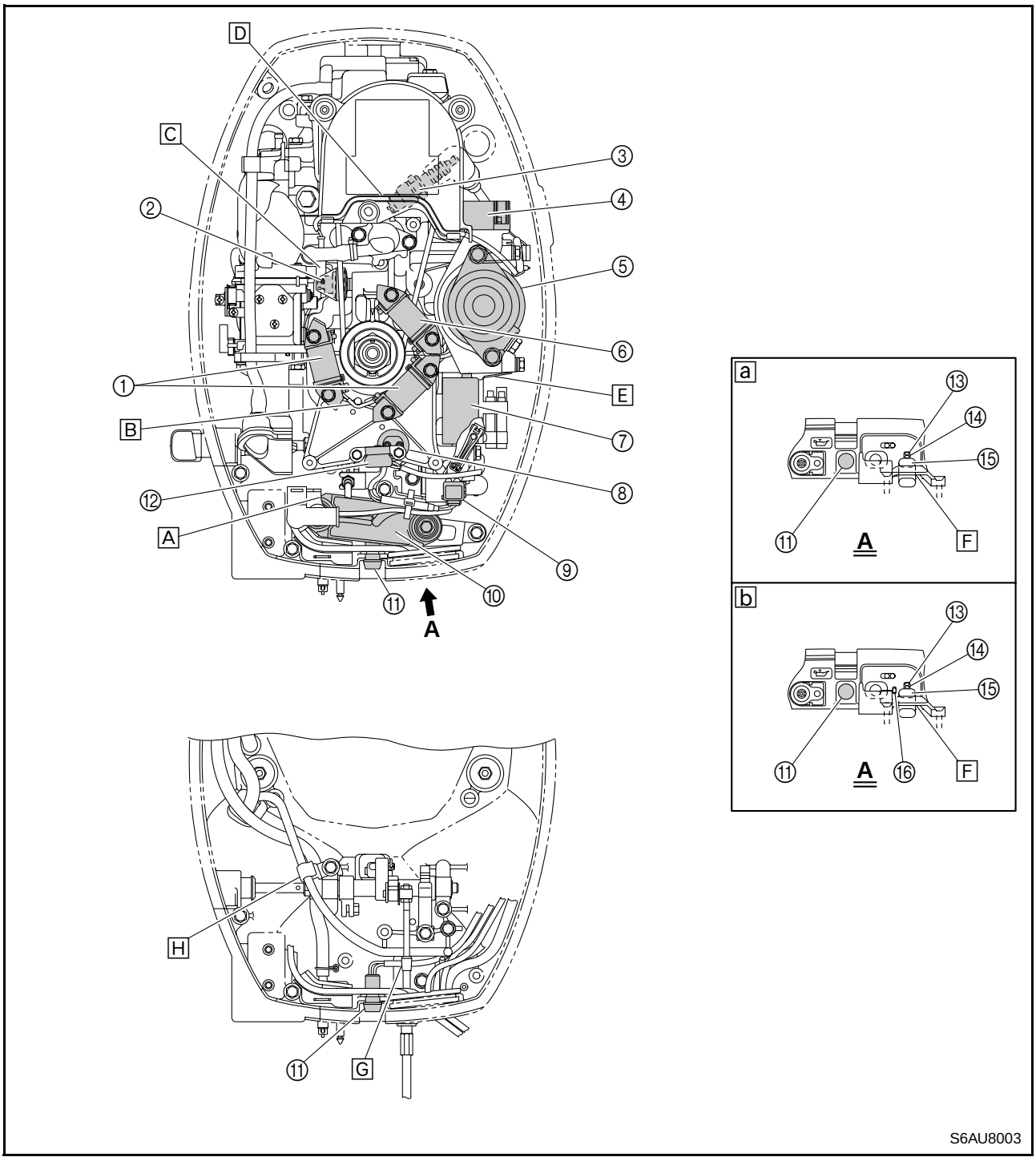


a H model (short)
b H model (long)

① Lighting coils
② Oil pressure switch
③ Spark plug
④ Rectifier Regulator
⑤ Charge coil
⑥ CDI unit
⑦ Pulser coil
⑧ Warning indicator
⑨ Engine shut-off switch lead

A Route the oil pressure switch lead in the direction shown.
B Fit the oil pressure switch lead into the groove in the driven sprocket cover.
C Bend the side of the junction box outward as shown.
D To tiller handle
E Route the warning indicator lead under the shift cable.

H model with electric starter



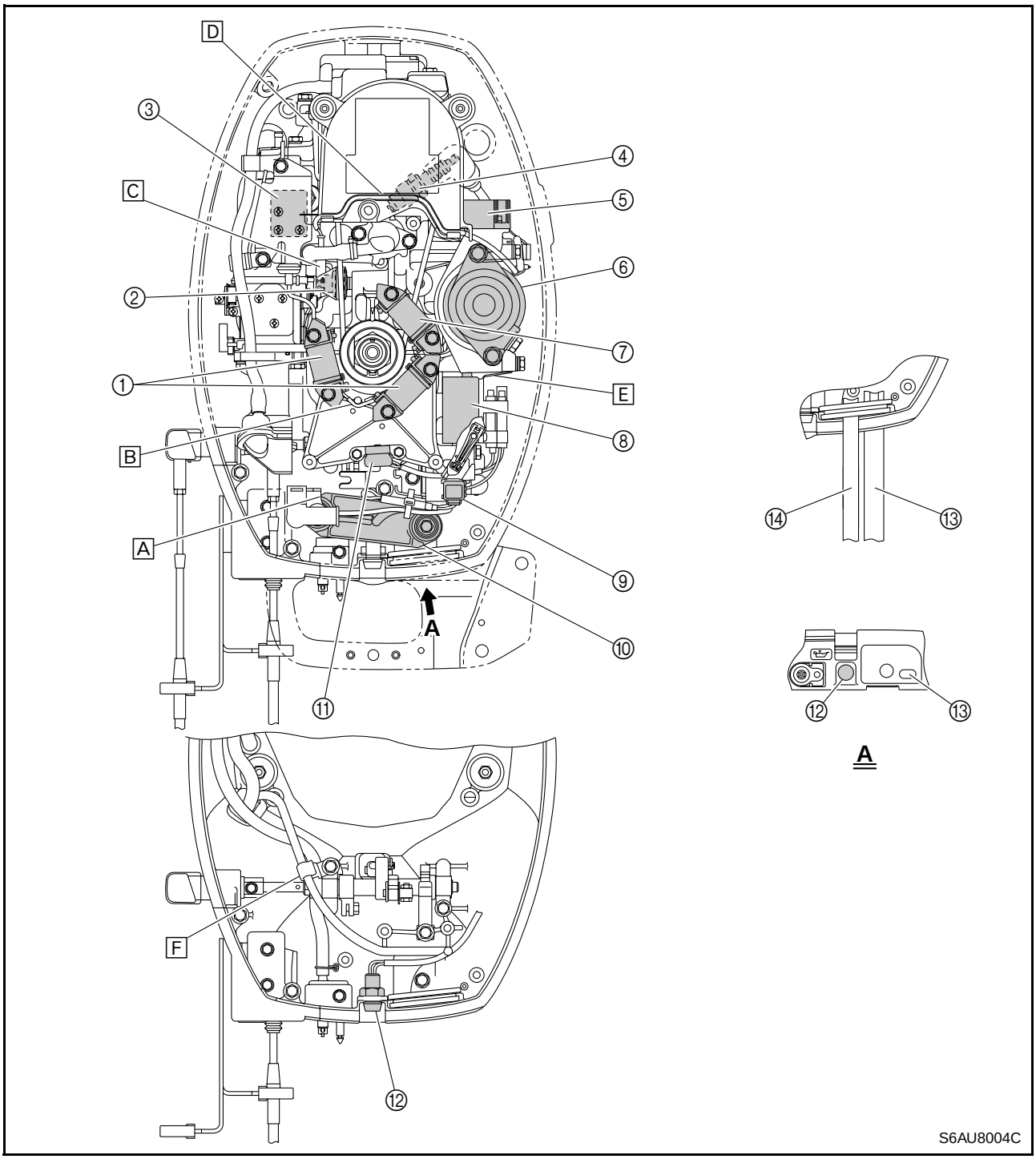
a MT model
b PT model

① Lighting coils
② Oil pressure switch
③ Spark plug
④ Rectifier Regulator
⑤ Starter motor
⑥ Charge coil
⑦ CDI unit
⑧ Neutral switch
⑨ Fuse (10 A)
⑩ PT relay (PT model)
⑪ Warning indicator
⑫ Pulser coil
⑬ Engine shut-off switch lead
⑭ Engine start button lead
⑮ Battery cable

⑯ PT switch lead (PT model)

A Install the terminal plate, making sure that it contacts the PT relay. (PT model)
B Route the lighting coil lead to the outside of the crankcase pin.
C Route the oil pressure switch lead in the direction shown.
D Fit the oil pressure switch lead into the groove in the driven sprocket cover.
E Bend the side of the junction box outward as shown.
F Route the battery cable under the bracket.
G Route the warning indicator lead under the shift cable.
H Fasten the PT motor lead with the holder, making sure that there is no slack in the lead. (PT model)

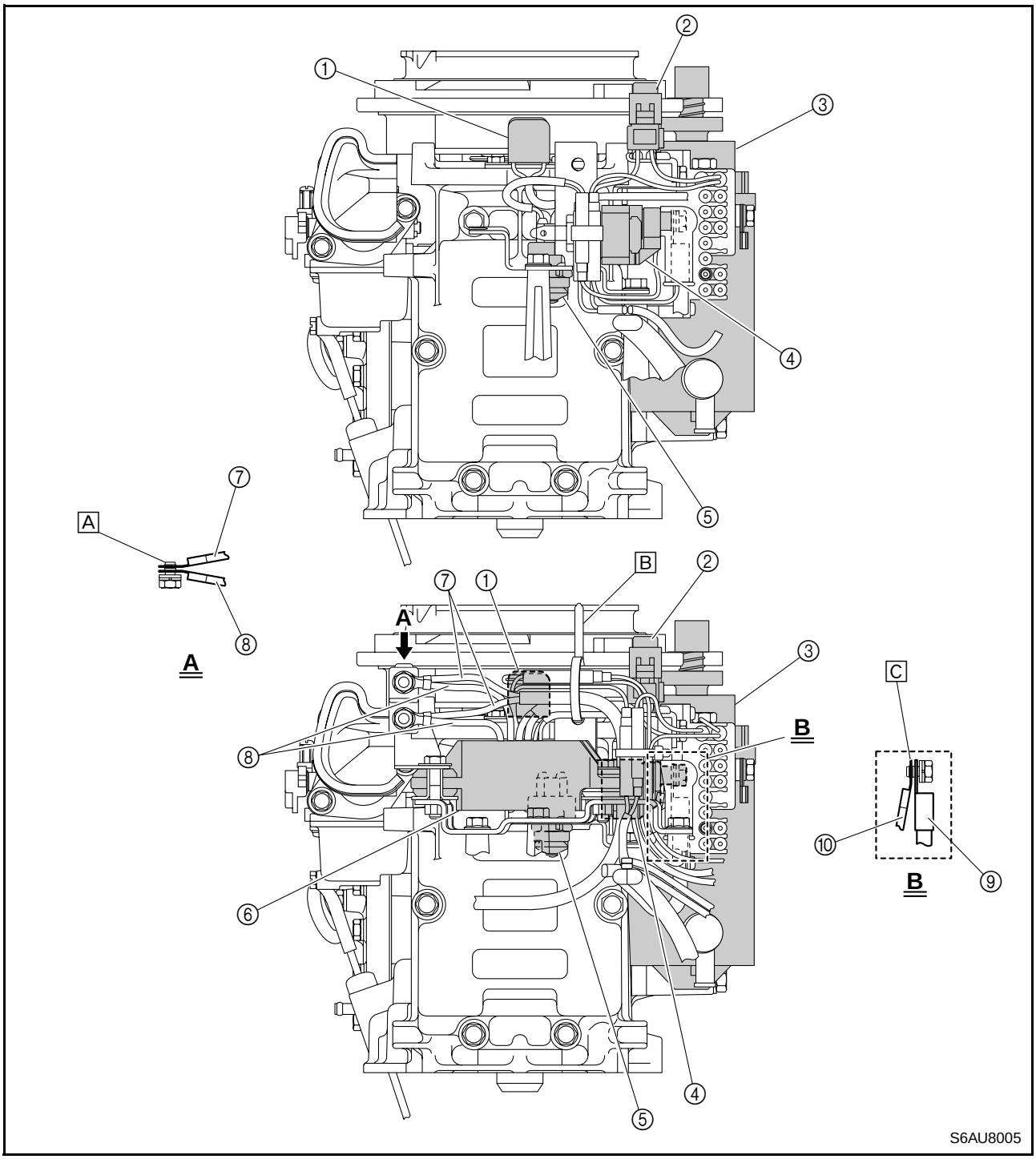
R model



① Lighting coils
② Oil pressure switch
③ Choke solenoid
④ Spark plug
⑤ Rectifier Regulator
⑥ Starter motor
⑦ Charge coil
⑧ CDI unit
⑨ Fuse (10 A)
⑩ PT relay (PT model)
⑪ Pulser coil
⑫ Warning indicator
⑬ Battery cable
⑭ 10-pin main harness

A Install the terminal plate, making sure that it contacts the PT relay. (PT model)
B Route the lighting coil lead to the outside of the crankcase pin.
C Route the oil pressure switch lead in the direction shown.
D Fit the oil pressure switch lead into the groove in the driven sprocket cover.
E Bend the side of the junction box outward as shown.
F Fasten the PT motor lead with the holder, making sure that there is no slack in the lead. (PT model)

Bow view

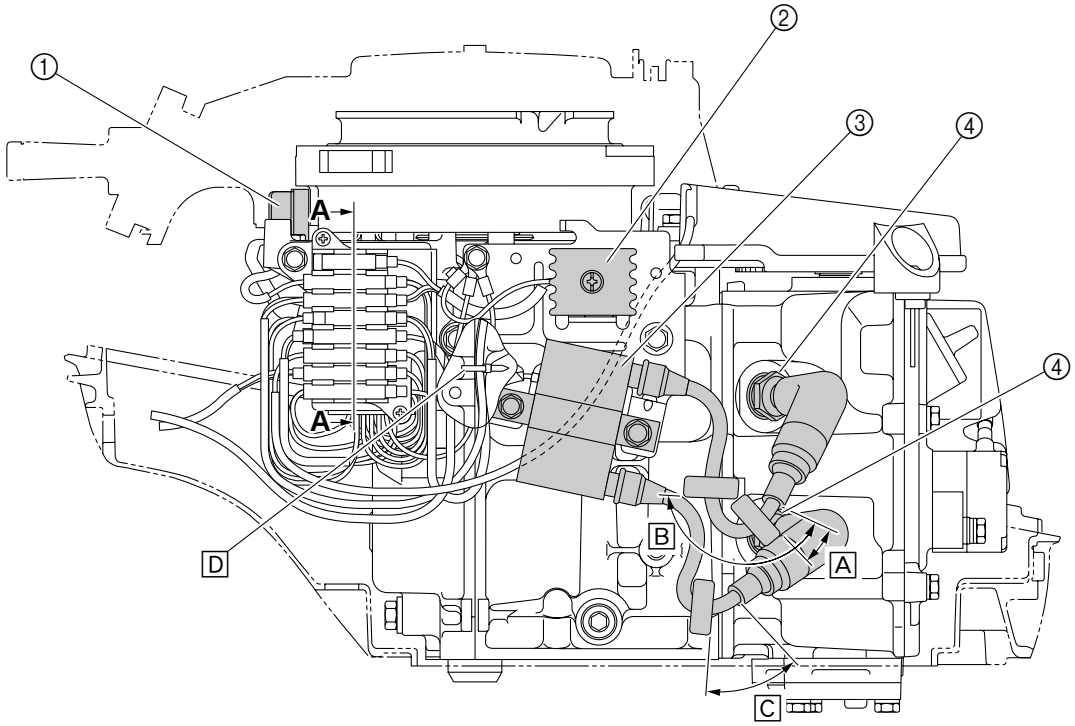


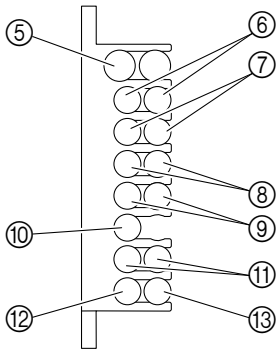
① Pulser coil
② Fuse (10 A) (E model)
③ Starter motor (E model)
④ Starter relay (E model)
⑤ Neutral switch (E model)
⑥ PT relay (PT model)
⑦ PT motor leads (Sb, Lg)
⑧ PT relay leads (Sb, Lg)
⑨ Negative battery cable
⑩ PT relay lead (R)

A Pass the PT motor leads (Sb, Lg) and PT relay leads (Sb, Lg) through the caps, and then connect the leads to the terminals and cover the connections with the caps. Be sure to pass leads of the same color through the caps and connect them to the same terminal. (PT model)
B Fasten the PT relay leads (Sb, Lg, R) (PT model), PT motor lead (PT model), and wiring harness connector (R) to the bracket with a plastic tie.
C Install the terminals of the negative battery cable and PT relay lead (R) (PT model) using the bolt as shown.

Port view

M model with 1 lighting coil





A-A

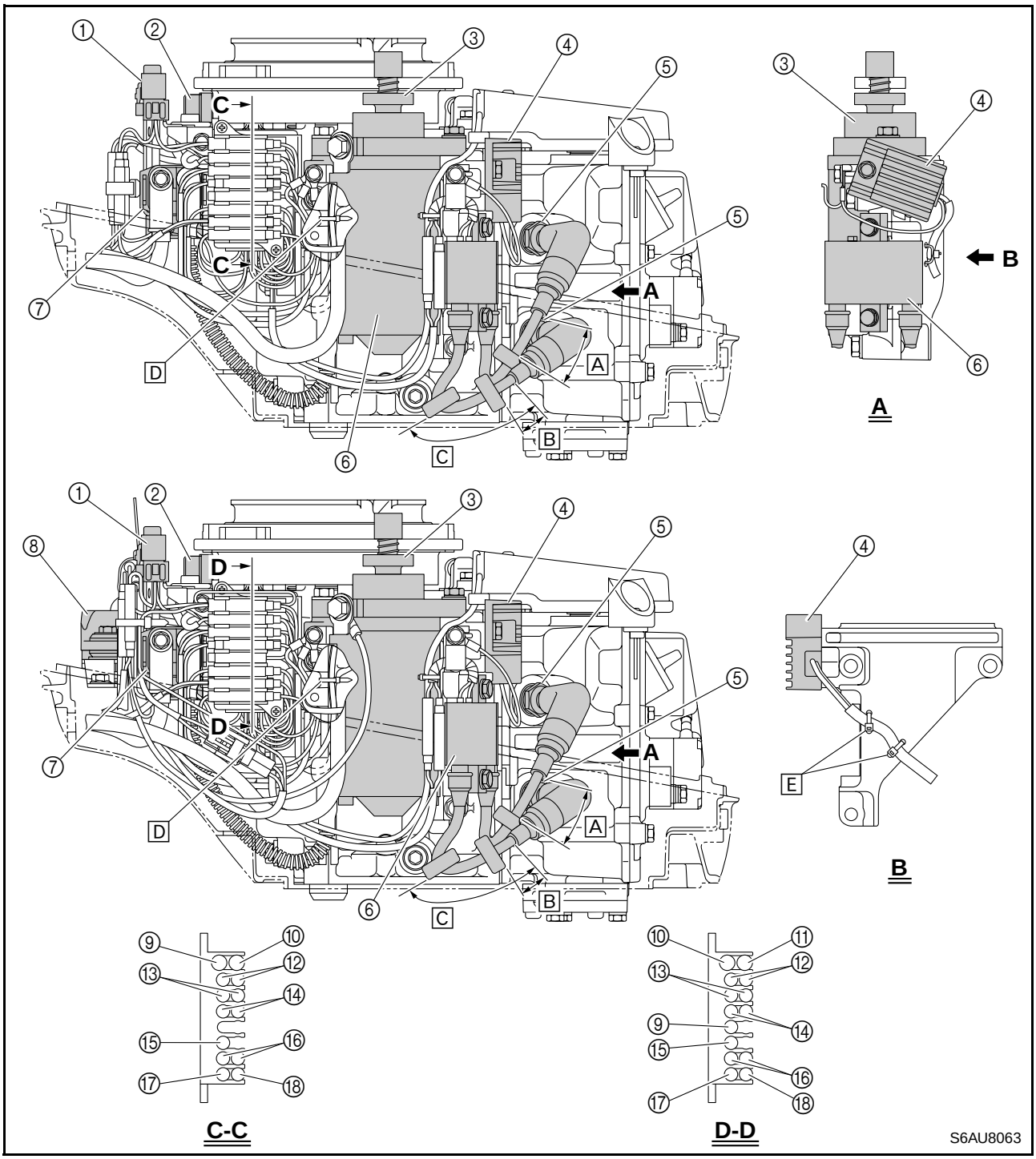
S6AU8062

① Pulser coil
② Rectifier
③ Ignition coil
④ Spark plugs
⑤ Rectifier connector (R)
⑥ Pulser coil connectors (pulser coil to CDI unit) (W/R, B)
⑦ Rectifier connectors (Rectifier to CDI unit) (G, G)
⑧ Charge coil connectors (charge coil to CDI unit) (L, Br)
⑨ Ignition coil connectors (ignition coil to CDI unit) (O, B)
⑩ Oil pressure switch connector (oil pressure switch to CDI unit) (P)
⑪ Warning indicator connectors (warning indicator to CDI unit) (Y/R, P)

⑫ Engine shut-off switch connector (engine shut-off switch to CDI unit) (Y)
⑬ Emergency circuit connector (CDI unit to CDI unit) (W)

Ⓐ 15 mm (0.59 in)
Ⓑ 55 mm (2.17 in)
Ⓒ 35 mm (1.38 in)
Ⓓ Fasten the charge coil lead and lighting coil lead with a plastic tie as shown so that they are not pinched when the flywheel magnet and ignition coil bracket are installed.

M model and E model with 2 lighting coils

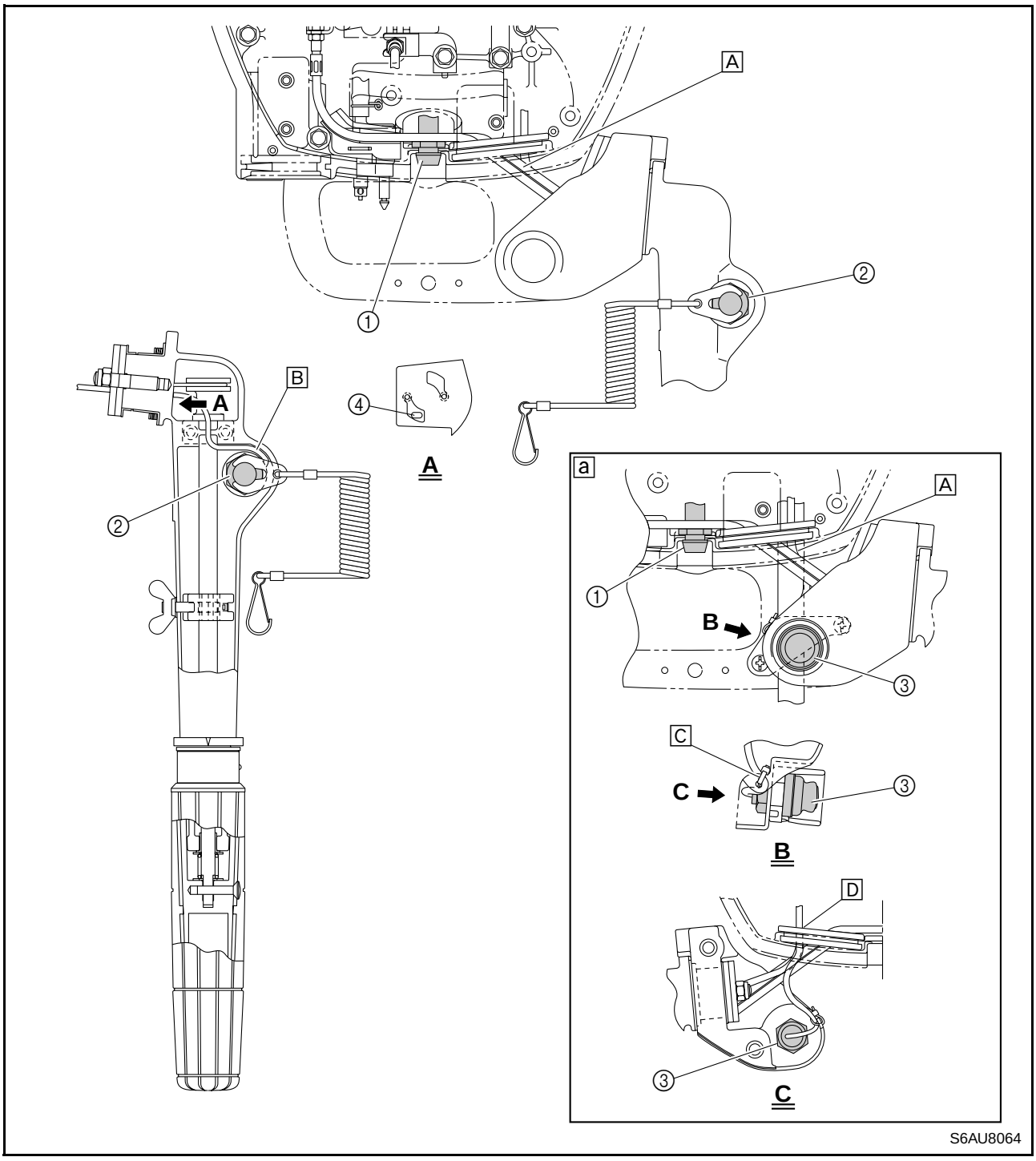


① Fuse (10 A) (E model)
② Pulser coil
③ Starter motor (E model)
④ Rectifier Regulator
⑤ Spark plugs
⑥ Ignition coil
⑦ Starter relay (E model)
⑧ PT relay (PT model)
⑨ Rectifier Regulator connector (G)
⑩ Rectifier Regulator connector (Rectifier Regulator to fuse and engine start button) (R)
⑪ Rectifier Regulator connector (Rectifier Regulator to PT switch) (R)
⑫ Pulser coil connectors (pulser coil to CDI unit) (W/R, B)
⑬ Rectifier Regulator connectors (Rectifier Regulator to CDI unit) (G, G/W)

⑭ Charge coil connectors (charge coil to CDI unit) (L, Br)
⑮ Oil pressure switch connector (oil pressure switch to CDI unit) (P)
⑯ Warning indicator connectors (warning indicator to CDI unit) (Y/R, P)
⑰ Engine shut-off switch connector (engine shut-off switch to CDI unit) (Y)
⑱ Emergency circuit connector (CDI unit to CDI unit) (W)

Ⓐ 35 mm (1.38 in)
Ⓑ 15 mm (0.59 in)
Ⓒ 55 mm (2.17 in)
Ⓓ Fasten the charge coil lead and lighting coil lead with a plastic tie as shown so that they are not pinched when the flywheel magnet and ignition coil bracket are installed.
Ⓔ Fasten the Rectifier Regulator lead to the starter motor bracket with plastic ties before installing the starter motor. Cut off the excess end of each plastic tie.

H model (short)

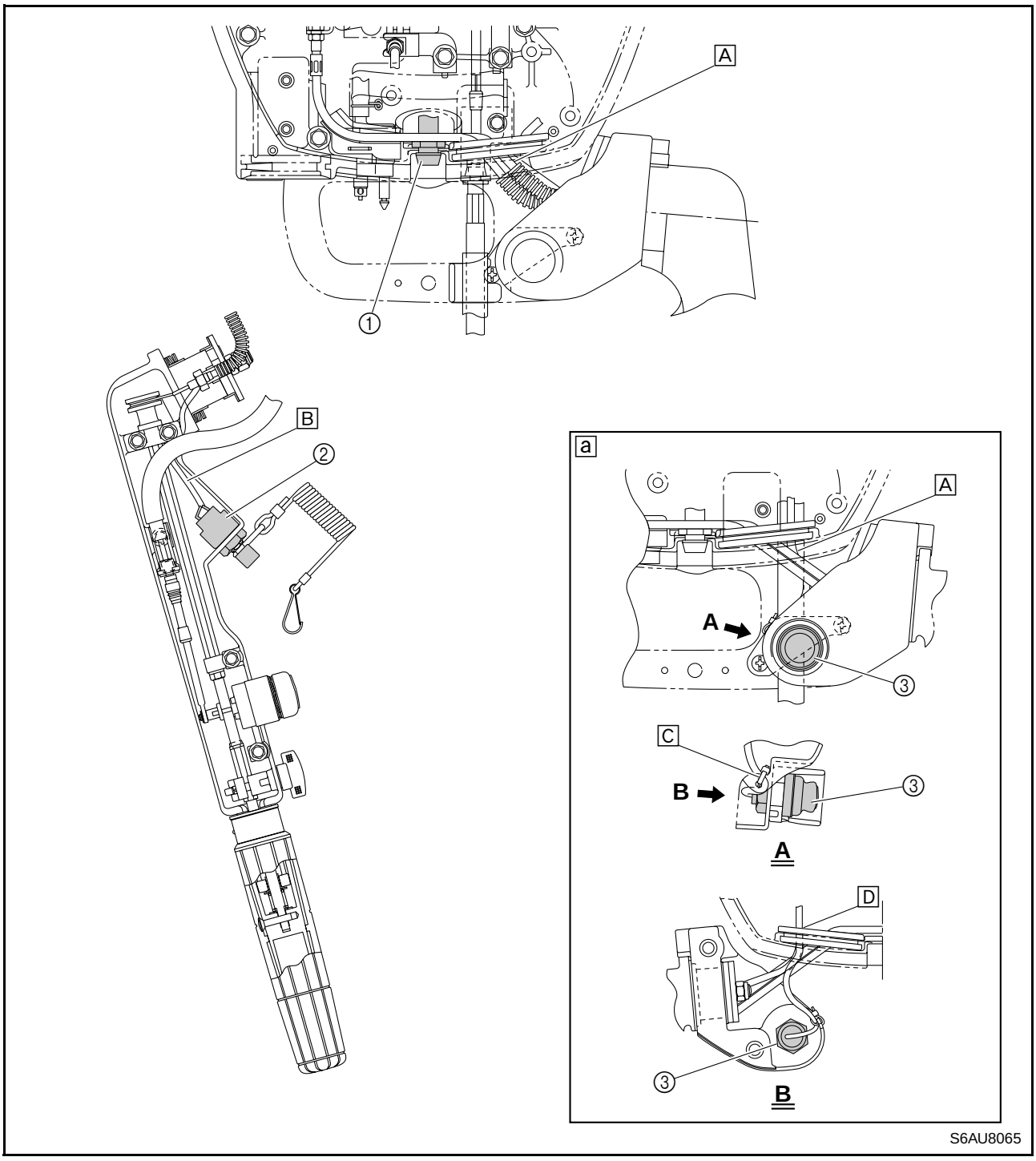


a E model

① Warning indicator
② Engine shut-off switch
③ Engine start button (E model)
④ Engine shut-off switch lead

A Route the engine shut-off switch lead under the throttle cables.
B Route the engine shut-off switch lead as shown, making sure that the lead does not contact the throttle shaft.
C Fasten the engine start button lead at the white tape with a plastic tie. Install the plastic tie as shown. (E model)
D Align the blue tape on the engine start button lead with the grommet in the bottom cowling. Position the slack in the engine start button lead toward the tiller handle. (E model)

H model (long)



a E model

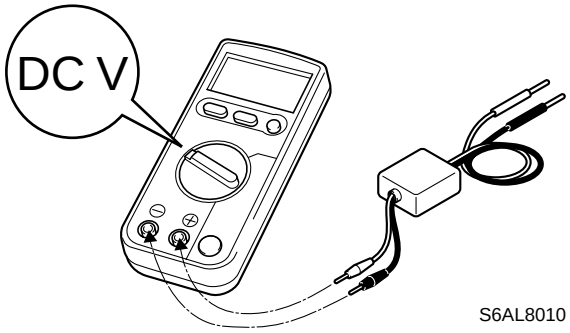
① Warning indicator
② Engine shut-off switch
③ Engine start button

A Route the engine shut-off switch lead under the throttle cables.
B Route the engine shut-off switch lead along the tiller handle bracket so that it does not contact the throttle shaft, and then route it and the throttle cables through the corrugated tube.
C Fasten the engine start button lead at the white tape with a plastic tie. Install the plastic tie as shown. (E model)
D Align the blue tape on the engine start button lead with the grommet in the bottom cowling. Position the slack in the engine start button lead toward the tiller handle. (E model)

Checking the electrical component

Measuring the peak voltage

To check the electrical components or measure the peak voltage, use the special service tools. A faulty electrical component can be easily checked by measuring the peak voltage. The specified engine speed when measuring the peak voltage is affected by many factors, such as fouled spark plugs or a weak battery. If one of these factors is present, the peak voltage cannot be measured properly.



S6AL8010

⚠ WARNING

When checking the peak voltage, do not touch any of the connections of the digital tester leads.

CAUTION:

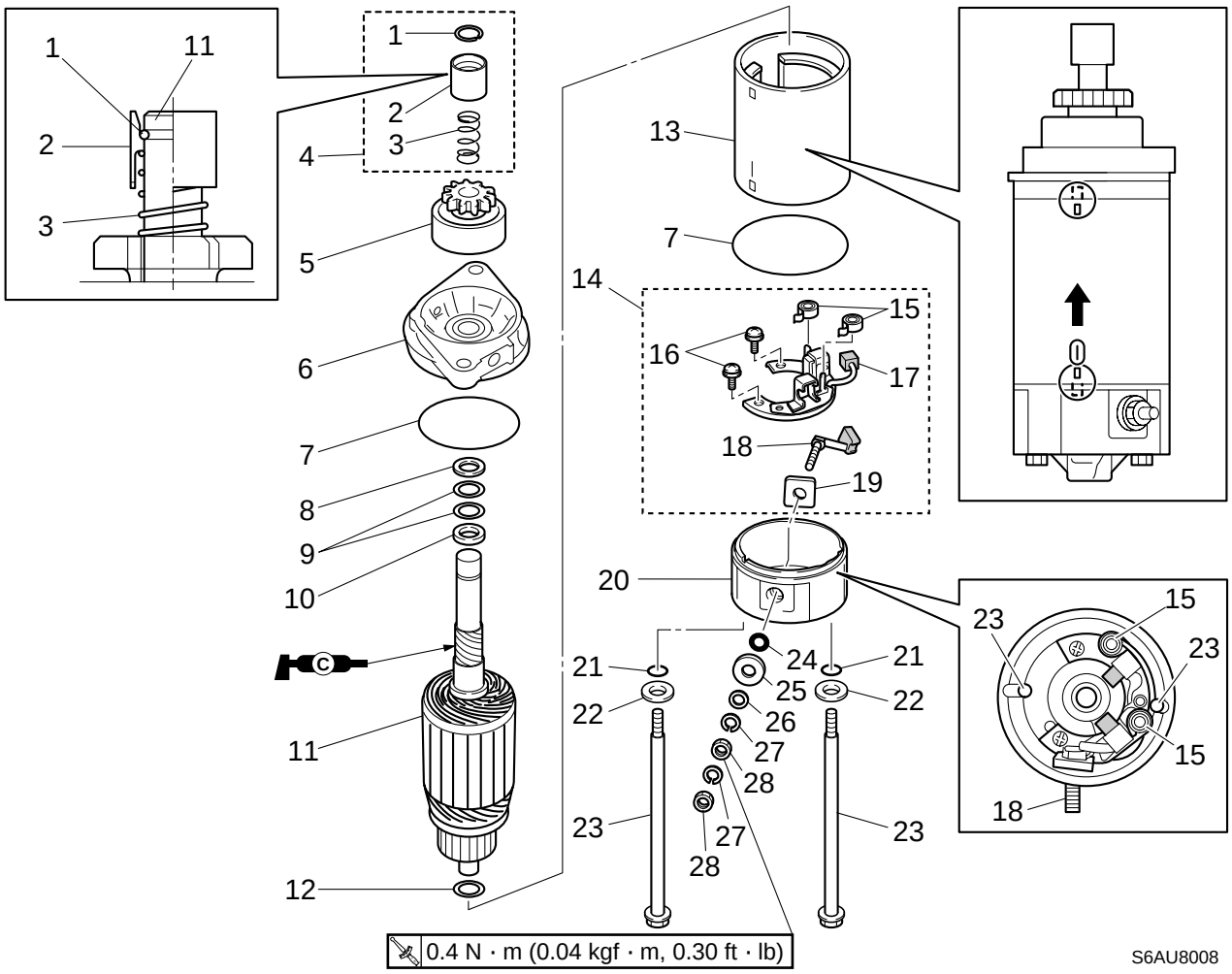
When testing the voltage between the terminals of an electrical component with the digital tester, do not allow any of the leads to touch any metal parts. If touched, the electrical component can short and be damaged.

NOTE:

- Before measuring the peak voltage, check all wiring for proper connection and corrosion, and check that the battery is fully charged.
- Use the peak voltage adapter B with the recommended digital circuit tester.
- Connect the positive pin of peak voltage adapter B to the positive terminal of the digital tester, and the negative pin to the negative terminal.
- When measuring the peak voltage, set the selector on the digital circuit tester to the **DC voltage mode**.

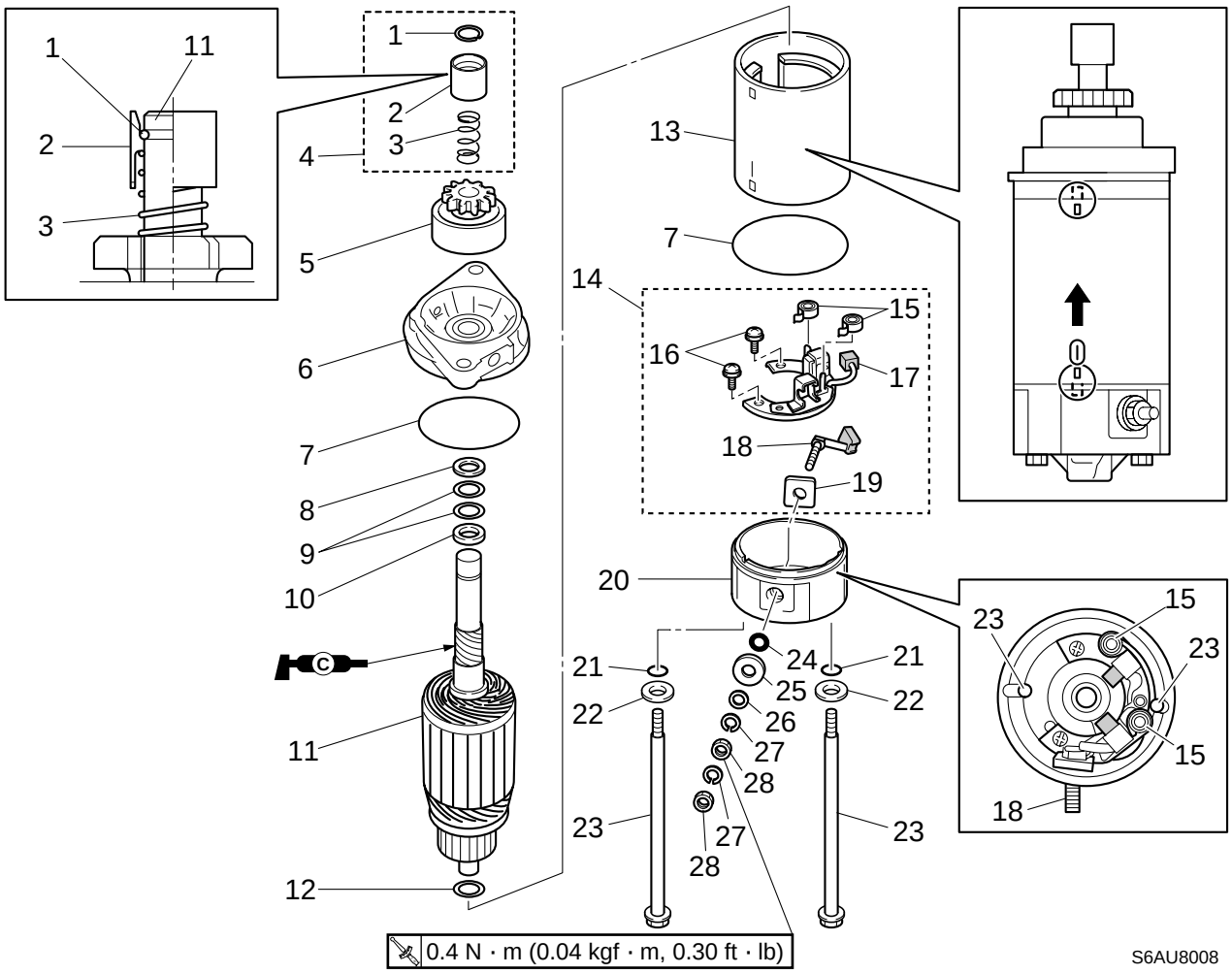
Digital circuit tester: 90890-03174
Peak voltage adapter B:
90890-03172

Starter motor (E model)



No.	Part name	Q'ty	Remarks
1	Clip	1	**Not reusable**
2	Pinion stopper	1	
3	Spring	1	
4	Pinion stopper set	1	
5	Pinion	1	
6	Cover	1	
7	O-ring	2	**Not reusable**
8	Washer	1	t = 1.0 mm
9	Shim	—	
10	Washer	1	t = 2.0 mm
11	Armature	1	
12	Washer	1	t = 0.25 mm
13	Stator	1	
14	Brush holder assembly	1	
15	Brush spring	2	
16	Screw	2	ø4 × 8 mm
17	Brush 2 assembly	1	

8



No.	Part name	Q'ty	Remarks
18	Brush 1	1	
19	Spacer	1	
20	Bracket	1	
21	O-ring	2	
22	Washer	2	
23	Bolt	2	M5 × 120 mm
24	O-ring	1	
25	Spacer	1	
26	Washer	1	
27	Spring washer	2	
28	Nut	2	

Removing the starter motor

1. Remove the starter motor from the power unit.

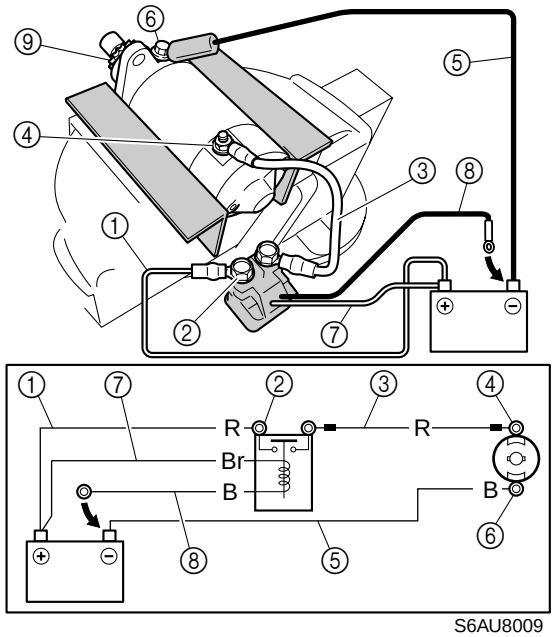
NOTE:
- Check the engine start switch or engine start button, neutral switch, starter relay, and fuse before removing the starter motor.
- To remove the starter motor, see "Ignition coil, CDI unit, and Rectifier Regulator (E model)" (5-15).

Checking the starter motor operation

1. Hold the starter motor in a vise using aluminum plates on both sides.

2. Connect the positive battery cable ① to the starter relay terminal ②, connect the starter motor lead ③ to the starter motor positive terminal ④, and connect the negative battery cable ⑤ to the starter motor body ⑥.

3. Connect the starter relay lead (brown) ⑦ to the positive battery terminal. Connect the starter relay lead (black) ⑧ to the negative battery terminal to check the starter motor operation.



S6AU8009

⚠ WARNING

Do not place any objects near the pinion or touch it. The pinion ⑨ moves slightly away from the starter motor body and rotates at high speed.

NOTE:
- Check the starter motor operation for a few seconds.
- If the starter motor is disassembled for maintenance, be sure to check the operation again after assembling it.

4. Disconnect the negative battery cable and positive battery cable from the battery terminals.

Checking the starter motor pinion

CAUTION:

Be sure to disconnect the battery cables before checking the starter motor pinion.

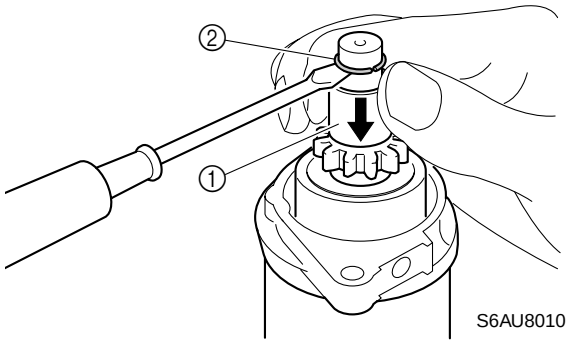
1. Check the pinion teeth. Replace the pinion if cracked or worn.

2. Check the pinion for smooth operation.

NOTE:
Turn the pinion counterclockwise to check that it operates smoothly and turn it clockwise to check that it locks in place.

Disassembling the starter motor

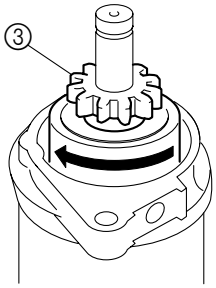
1. Slide the pinion stopper ① down as shown, and then remove the clip ②, pinion stopper, and spring.



S6AU8010

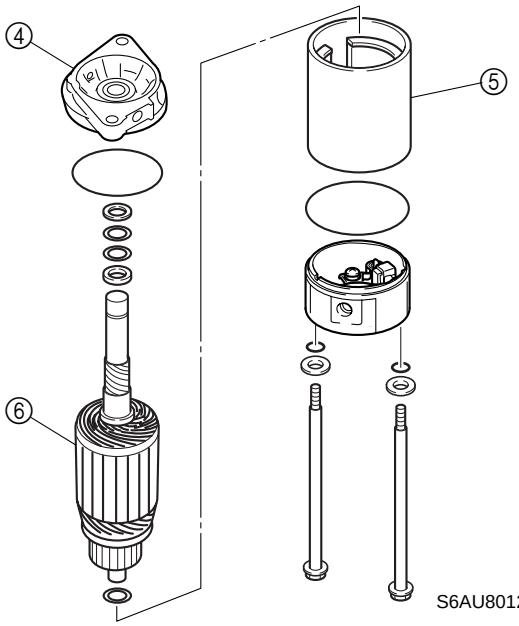
8

2. Turn the pinion ③ clockwise, and then remove the pinion.



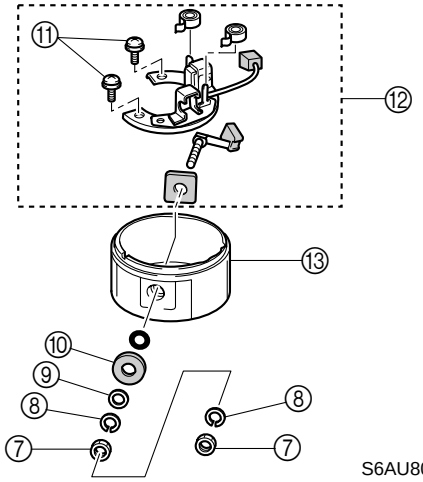
S6AU8011

3. Remove the cover ④, stator ⑤, armature ⑥, and washer.



S6AU8012

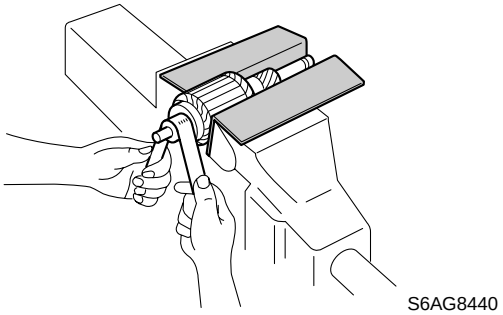
4. Remove the nuts ⑦, spring washers ⑧, washer ⑨, spacer ⑩, and screws ⑪, and then remove the brush holder assembly ⑫ from the bracket ⑬.



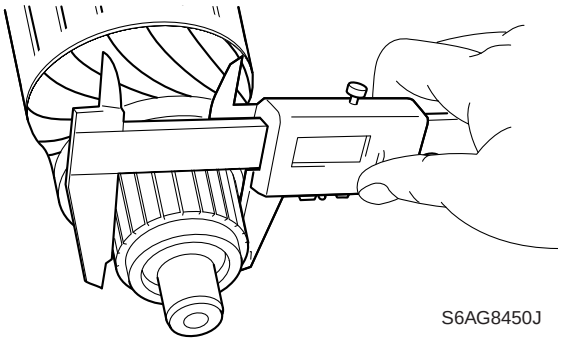
S6AU8013

Checking the starter motor

1. Check the commutator. Clean with 600-grit sandpaper and compressed air if dirty.

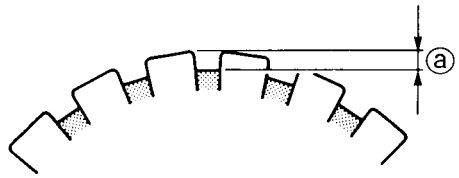

S6AG8440

2. Measure the commutator diameter. Replace the armature if below specification.


S6AG8450J

Commutator standard diameter:
30.0 mm (1.18 in)
Wear limit: 29.0 mm (1.14 in)

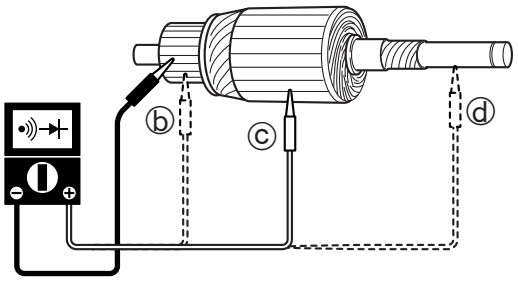
3. Measure the commutator undercut ⓐ. Replace the armature if below specification.



S69J8410

Commutator standard undercut ⓐ:
0.5–0.8 mm (0.02–0.03 in)
Wear limit: 0.2 mm (0.01 in)

4. Check the armature for continuity. Replace the armature if out of specification.



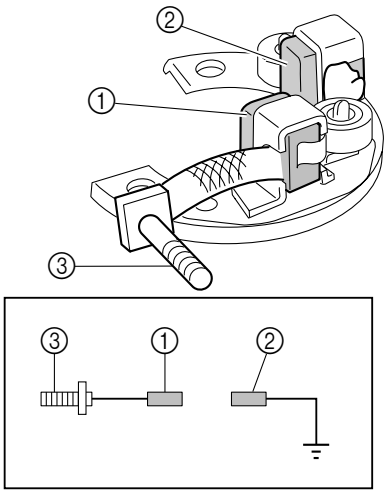
S6AU8017

Armature continuity

Checking points	Continuity
Commutator segments ⓑ	Yes
Segment – Armature core ⓒ	No
Segment – Armature shaft ⓓ	No

Checking the brush holder and brush

1. Check the brush holder assembly for continuity. Replace if out of specification.

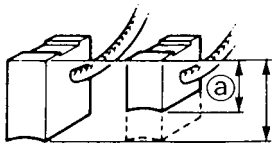


S6AG8470

Brush holder assembly continuity

Checking points	Continuity
Brush ① – Terminal ③	Yes
Brush ① – Brush ② Brush ② – Terminal ③	No

2. Measure the length of each brush. Replace if below specification.



S69J8430

Brush standard length:
12.5 mm (0.49 in)
Wear limit ⓐ: 9.0 mm (0.35 in)

8

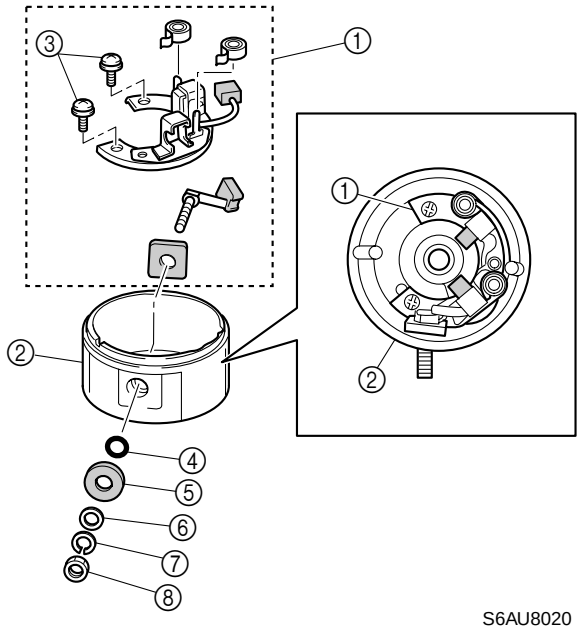
Assembling the starter motor

CAUTION:

Do not allow grease or oil to contact the commutator of the armature.

1. Install the brush holder assembly ① into the bracket ②, and then tighten the screws ③.

2. Install the O-ring ④, spacer ⑤, washer ⑥, and spring washer ⑦, and then tighten the nut ⑧ to the specified torque.

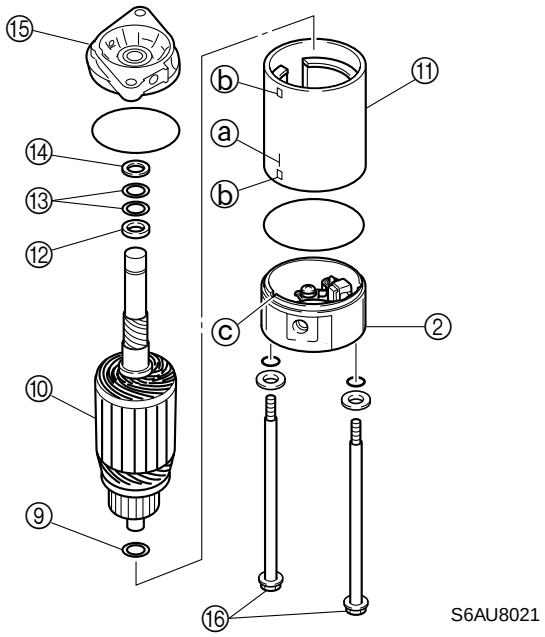


S6AU8020

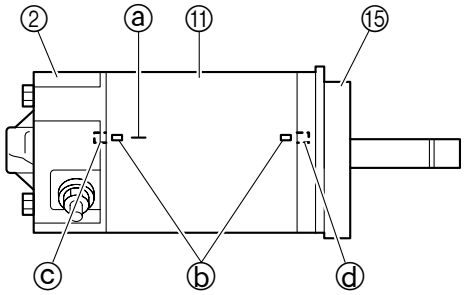
Starter motor terminal nut ⑧:
0.4 N·m (0.04 kgf·m, 0.30 ft·lb)

3. Install the washer ⑨ and armature ⑩ into the bracket ②.

4. Install the stator ⑪, washer ⑫, shim(s) ⑬, washer ⑭, and cover ⑮, and then tighten the bolts ⑯.



S6AU8021



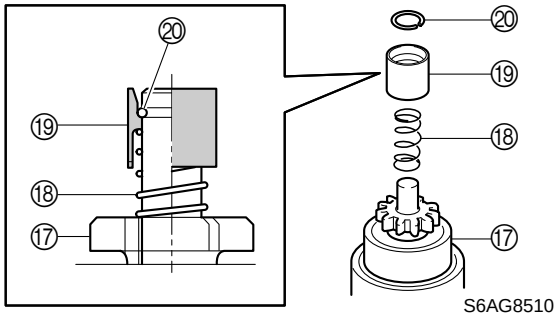
S6AU8022

NOTE:

- Install the stator so that the line mark ⓐ is toward the bracket ②.
- Align the projections ⓑ on the stator ⑪ with the groove ⓒ in the bracket ② and the groove ⓓ in the cover ⑮.

5. Install the pinion ⑰, spring ⑱, and pinion stopper ⑲.

6. Slide the pinion stopper down, and then install a new clip ⑳.



S6AG8510

NOTE:
- Install the pinion stopper ⑲ in the direction shown.
- Check the starter motor operation again after assembling it.

Installing the starter motor

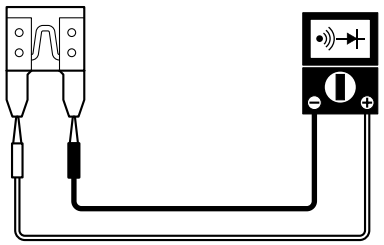
1. Install the starter motor to the power unit.
2. Connect the wiring harness to the starter motor, and then fasten the wiring harness.

NOTE:
To connect the wiring harness to the starter motor, see “Electrical component and wiring harness routing” (8-1).

Starting system

Checking the fuse (E model)

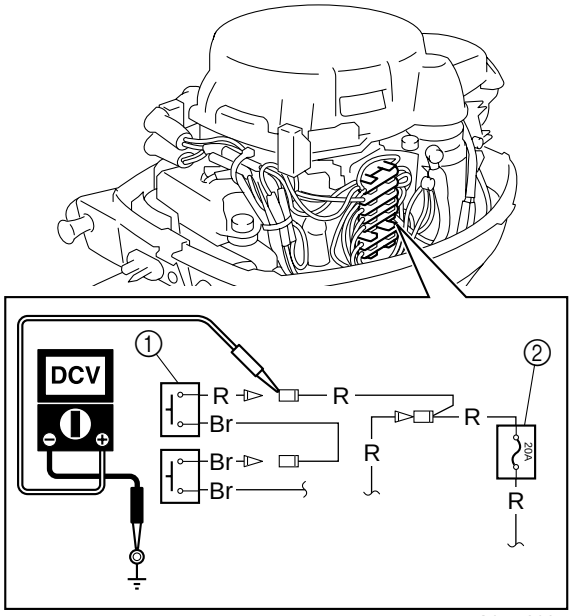
1. Check the fuse for continuity. Replace if there is no continuity.


S6AU8024

NOTE:
For the location of the fuse, see “Electrical component and wiring harness routing” (8-1).

Checking the engine start button (H model with electric starter)

1. Disconnect the engine start button ① connectors.
2. Measure the input voltage between the connector (wiring harness end) of the engine start button ① and the ground. Check the fuse ② and wiring harness if below specification.

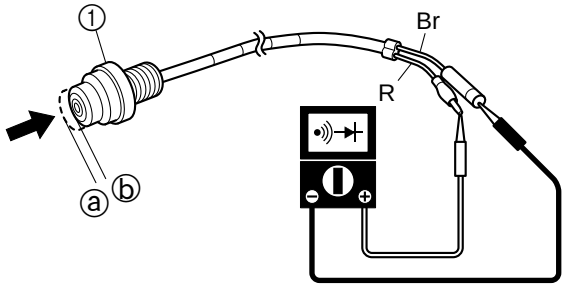


S6AU8025

Engine start button input voltage (reference data):
Red (R) – Ground
12 V (battery voltage)

8

3. Check the engine start button ① for continuity between the engine start button connectors (engine start button end). Replace if out of specification.



S6AG8180

Engine start button continuity:
Red (R) – Brown (Br)

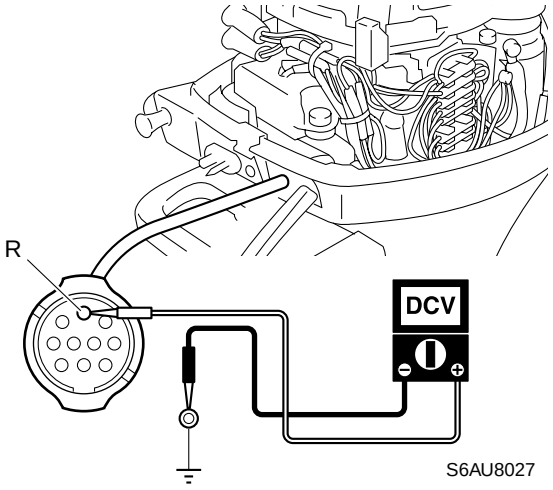
Button position	Continuity
Free ⓐ	No
Pushed ⓑ	Yes

4. Connect the connectors of the engine start button ①.

Checking the engine start switch (R model)

1. Disconnect the 10-pin main harness coupler.

2. Measure the input voltage between the 10-pin main harness coupler (outboard motor end) and the ground. Check the fuse and wiring harness if below specification.

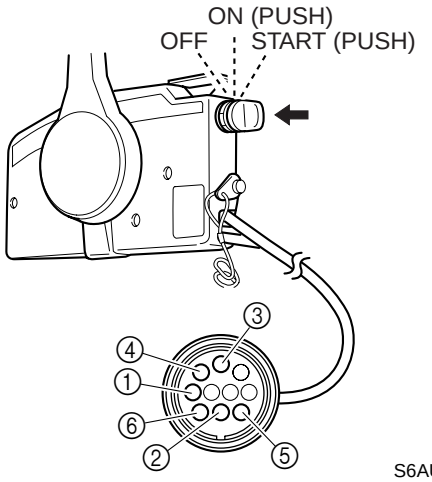


S6AU8027

Engine start switch input voltage (reference data):
Red (R) – Ground
12 V (battery voltage)

3. Set the remote control lever to the N position.

4. Check the engine start switch for continuity at the 10-pin main harness coupler (remote control box end). Check the wiring harness and neutral switch, or replace the engine start switch if out of specification.



S6AU8028

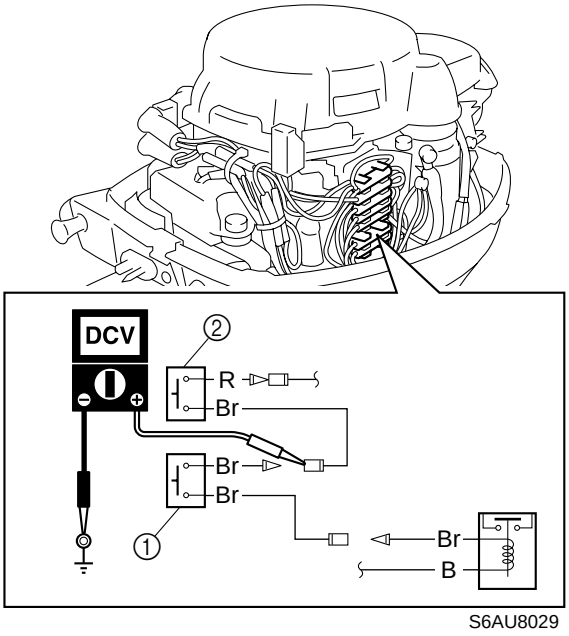
Switch position	Lead color					
	White (W) ①	Black (B) ②	Red (R) ③	Yellow (Y) ④	Brown (Br) ⑤	Blue (L) ⑥
OFF	○	○				
ON			○	○		
ON (PUSH)			○	○		○
START			○	○	○	
START (PUSH)			○	○	○	○

5. Connect the 10-pin main harness coupler.

Checking the neutral switch (H model with electric starter)

1. Disconnect the neutral switch ① connectors.

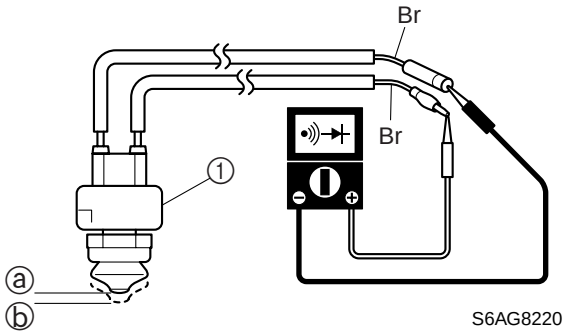
2. Push the engine start button ②, and then measure the input voltage between the neutral switch connector (engine start button end) and the ground. Check the engine start button and wiring harness if below specification.



S6AU8029

Neutral switch input voltage (reference data):
Brown (Br) – Ground
12 V (battery voltage)

3. Check the neutral switch ① for continuity between the neutral switch connectors (neutral switch end). Replace if out of specification.



S6AG8220

Neutral switch continuity:
Brown (Br) – Brown (Br)

Switch position	Continuity
Pushed ⓐ (N position)	Yes
Free ⓑ (F position or R position)	No

4. Connect the connectors of the neutral switch ①.

Checking the neutral switch (R model)

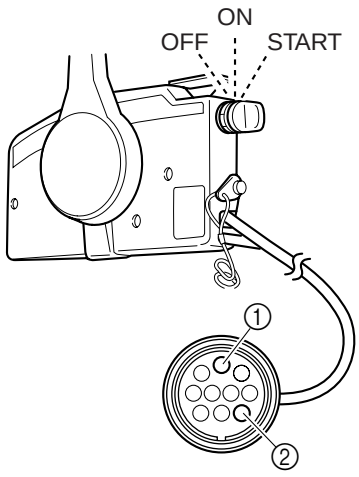
NOTE:
Be sure to check the engine start switch for continuity before checking the neutral switch.

1. Set the remote control lever to the N position.

2. Turn the engine start switch to “START,” and then check the neutral switch for continuity at the 10-pin main harness coupler (remote control box end).

8

3. Set the remote control lever to the F position or R position, and then check the neutral switch for continuity. Check the wiring harness or replace the neutral switch if out of specification.



S6AU8031

Remote control lever position	Lead color	
	Red (R) ①	Brown (Br) ②
N position	○	○
F position or R position		

4. Turn the engine start switch to “OFF.”

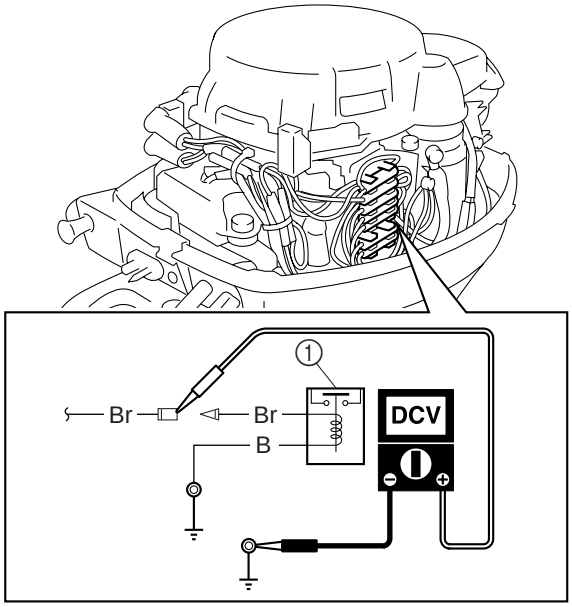
5. Connect the 10-pin main harness coupler.

Checking the starter relay (E model)

1. Disconnect the starter relay ① connector.

2. Set the shift lever or remote control lever to the N position.

3. Push the engine start button, and then measure the input voltage between the starter relay connector (neutral switch end) and the ground. Check the engine start button, neutral switch, wiring harness, and ground lead if below specification. (H model)
   Turn the engine start switch to “START,” and then measure the input voltage between the starter relay connector (neutral switch end) and the ground. Check the engine start switch, neutral switch (in the remote control box), wiring harness, and ground lead if below specification. (R model)



S6AU8032

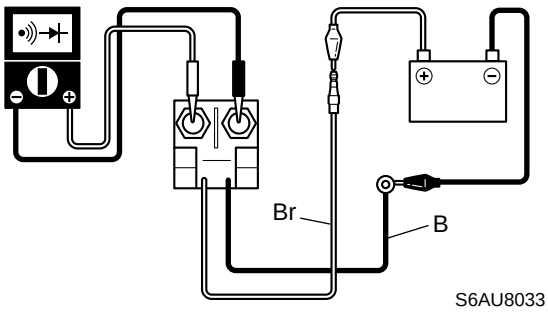
Starter relay input voltage (reference data):
Brown (Br) – Ground
12 V (battery voltage)

4. Disconnect the battery cables, and then remove the starter relay.

5. Connect the digital circuit tester leads to the starter relay terminals.

6. Connect the brown (Br) lead of the starter relay to the positive battery terminal and connect the black (B) lead to the negative battery terminal. Check for continuity between the starter relay terminals. Replace if there is no continuity.

7. Disconnect the brown (Br) or black (B) lead of the starter relay from a battery terminal. Check that there is no continuity between the starter relay terminals. Replace if there is continuity.



8. Install the starter relay, and then connect the battery cables, starter relay connector, and starter relay leads.

Ignition and ignition control system

Checking the ignition spark

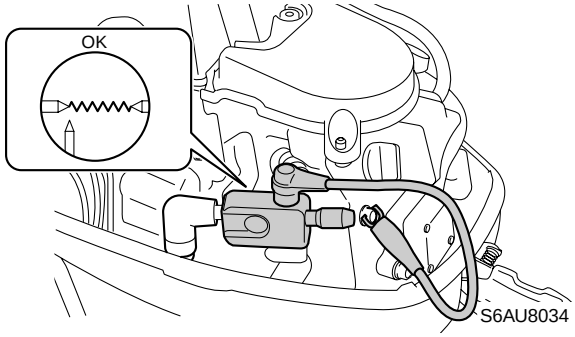
1. Disconnect the spark plug caps from the spark plugs.

NOTE:
To prevent the engine from starting when cranking it, be sure to disconnect both spark plug caps.

2. Connect the spark plug cap to the special service tool.

	Ignition tester: 90890-06754

3. Crank the engine and check for a spark. If there is no spark, check the ignition system.



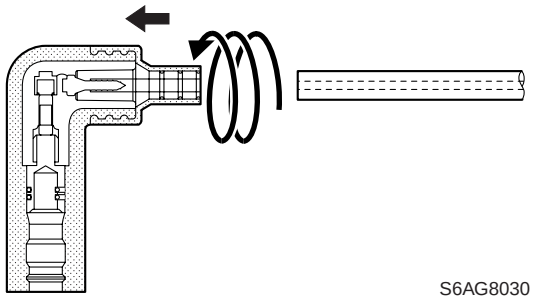
⚠ WARNING

- **Do not touch any of the connections of the special service tool.**
- **Be sure to install the special service tool to the spark plug cap so that sparks do not leak out.**
- **Keep flammable gas or liquids away, since this test can produce sparks.**

NOTE:
Repeat steps 2–3 for each spark plug cap.

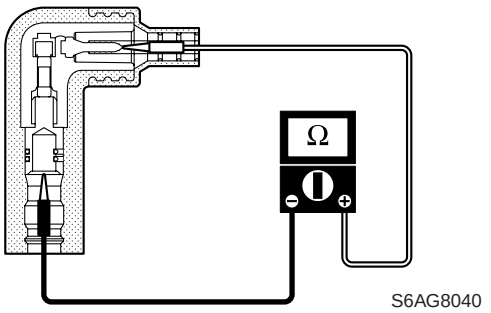
Checking the spark plug cap

1. Remove the spark plug caps from the spark plug wires by turning the caps counterclockwise.



8

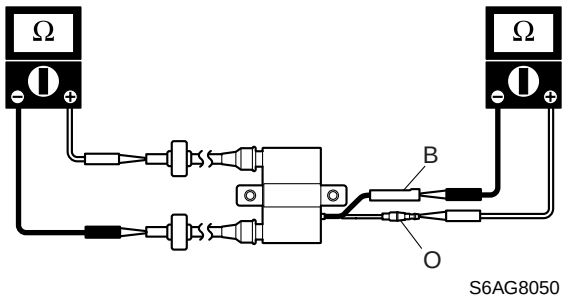
2. Measure the spark plug cap resistance. Replace if out of specification.



Spark plug cap resistance (reference data): 4.0–6.0 kΩ

Checking the ignition coil

1. Disconnect the ignition coil connectors.
2. Remove the spark plug caps from the spark plug wires by turning the caps counterclockwise.
3. Measure the ignition coil resistance. Replace if out of specification.

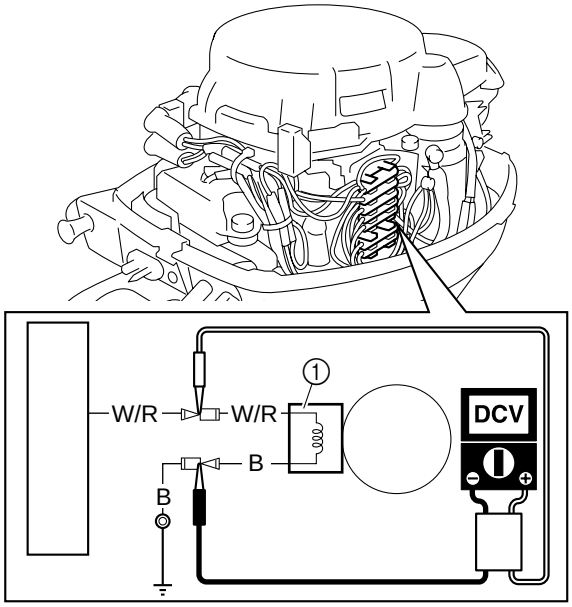


Ignition coil resistance (reference data):
Primary coil:
Orange (O) – Black (B)
0.26–0.35 Ω at 20 °C (68 °F)
Secondary coil:
Spark plug wire – Spark plug wire
6.8–10.2 kΩ at 20 °C (68 °F)

4. Install the spark plug caps to the spark plug wires by turning the caps clockwise, and then connect the ignition coil connectors.

Checking the pulser coil

1. Measure the pulser coil ① output peak voltage. Replace if below specification.



NOTE:
- To prevent the engine from starting when cranking it, be sure to disconnect both spark plug caps.
- Do not remove the clip from the engine shut-off switch.
- If measuring the output peak voltage under the unloaded conditions, disconnect the connectors.
- When using the manual starter to crank the engine, the voltage values may vary depending on the speed at which the starter handle is pulled.

Pulser coil output peak voltage:
White/red (W/R) – Black (B)

r/min	Unloaded	Loaded		
	Cranking		1,500	3,500
DC V	7.0	3.5	7.0	10.5

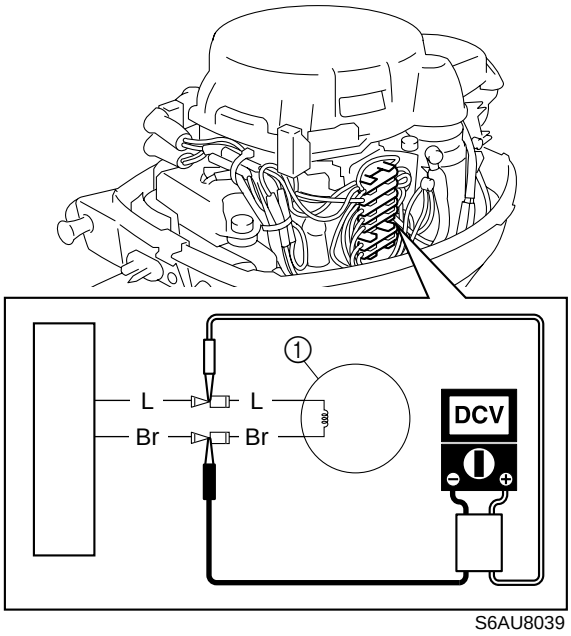
2. Disconnect the pulser coil connectors.
3. Measure the pulser coil resistance. Replace if out of specification.

Pulser coil resistance (reference data):
White/red (W/R) – Black (B)
240–360 Ω at 20 °C (68 °F)

4. Connect the pulser coil connectors.

Checking the charge coil

1. Measure the charge coil ① output peak voltage. Replace the stator coil assembly if below specification.



S6AU8039

NOTE:
- To prevent the engine from starting when cranking it, be sure to disconnect both spark plug caps.
- Do not remove the clip from the engine shut-off switch.
- If measuring the output peak voltage under the unloaded conditions, disconnect the connectors.
- When using the manual starter to crank the engine, the voltage values may vary depending on the speed at which the starter handle is pulled.

Charge coil output peak voltage:
Brown (Br) – Blue (L)

r/min	Unloaded	Loaded		
	Cranking		1,500	3,500
DC V	140	160	180	180

2. Disconnect the charge coil connectors.

3. Measure the charge coil resistance. Replace if out of specification.

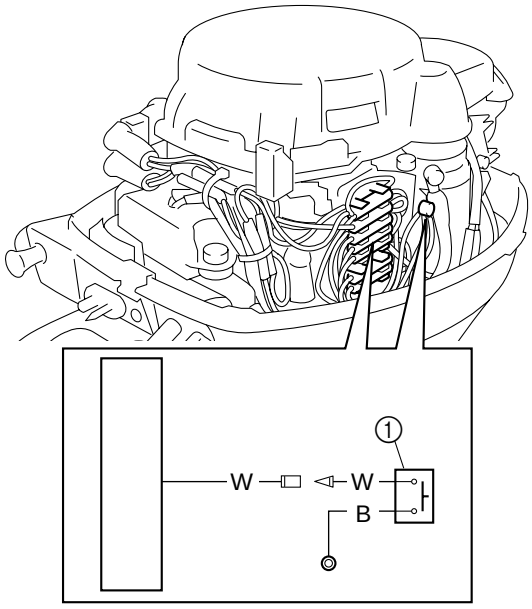
Charge coil resistance (reference data):
Brown (Br) – Blue (L)
232–348 Ω at 20 °C (68 °F)

4. Connect the charge coil connectors.

8

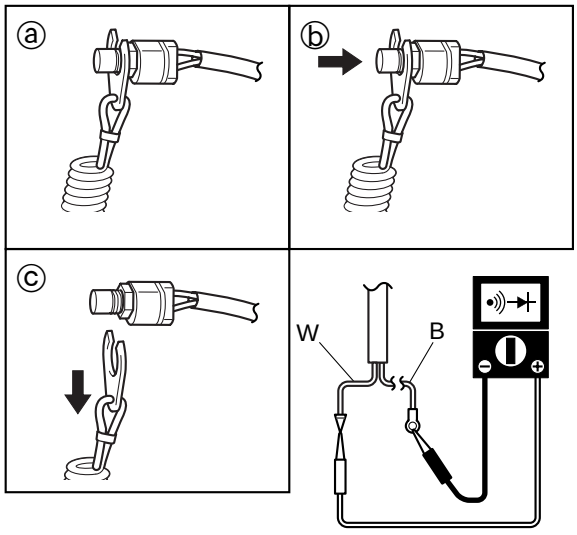
Checking the engine shut-off switch (H model)

1. Disconnect the engine shut-off switch ① connector and terminal.



S6AU8040

2. Check the engine shut-off switch ① for continuity between the engine shut-off switch connector and terminal (engine shut-off switch end). Replace if out of specification.



S6AG8150

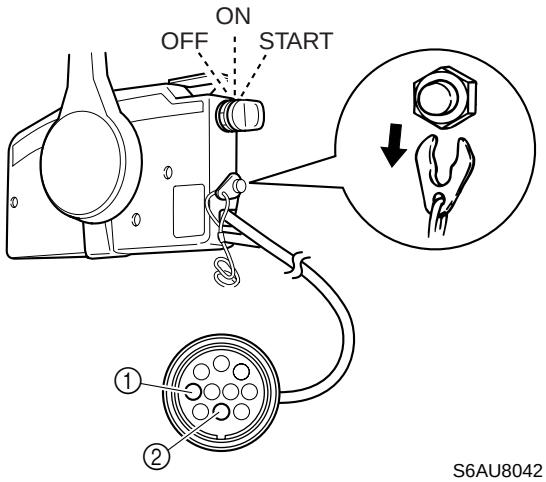
Engine shut-off switch continuity: White (W) – Black (B)	
Switch position	Continuity
Clip installed ⓐ	No
Engine stop button pushed ⓑ	Yes
Clip removed ⓒ	Yes

3. Connect the engine shut-off switch connector and terminal.

Checking the engine shut-off switch (R model)

1. Disconnect the 10-pin main harness coupler.

2. Turn the engine start switch to “ON,” and then check the engine shut-off switch for continuity at the 10-pin main harness coupler (remote control box end). Check the wiring harness or replace the engine shut-off switch if out of specification.



S6AU8042

Engine shut-off switch continuity: White (W) ① – Black (B) ②	
Switch position	Continuity
Clip installed	No
Clip removed	Yes

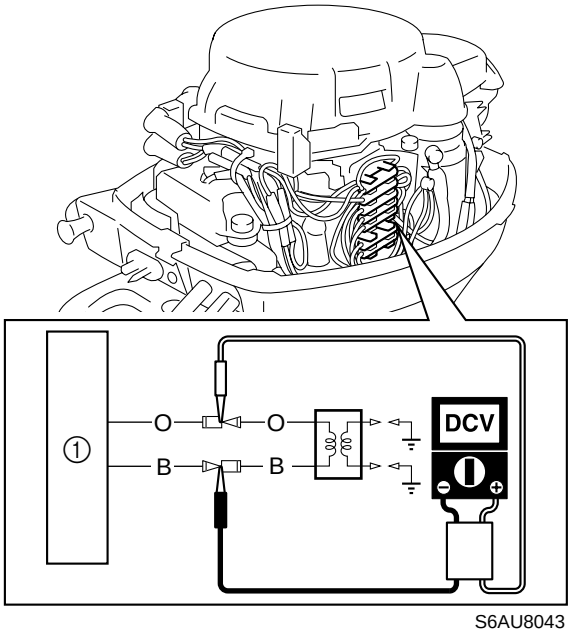
3. Turn the engine start switch to “OFF.”

4. Connect the 10-pin main harness coupler.

Engine electric control system

Checking the CDI unit

1. Measure the CDI unit ① output peak voltage. Replace if below specification.



S6AU8043

NOTE:

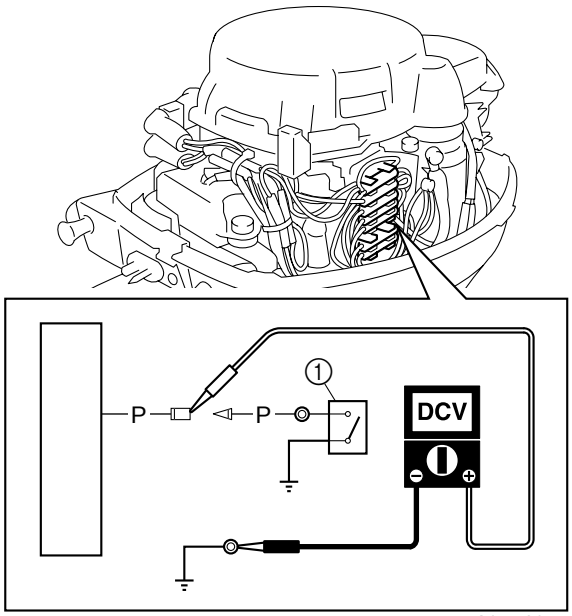
- To prevent the engine from starting when cranking it, be sure to disconnect both spark plug caps.
- Do not remove the clip from the engine shut-off switch.
- When using the manual starter to crank the engine, the voltage values may vary depending on the speed at which the starter handle is pulled.
- Be sure to check the charge coil and pulser coil before measuring the CDI unit output peak voltage.

CDI unit output peak voltage (reference data):
Orange (O) – Black (B)

r/min	Loaded		
	Cranking	1,500	3,500
DC V	140	170	170

Checking the oil pressure switch

1. Disconnect the oil pressure switch ① connector.
2. Start the engine, and then measure the input voltage between the oil pressure switch connector (wiring harness end) and the ground. Check the wiring harness if below specification.



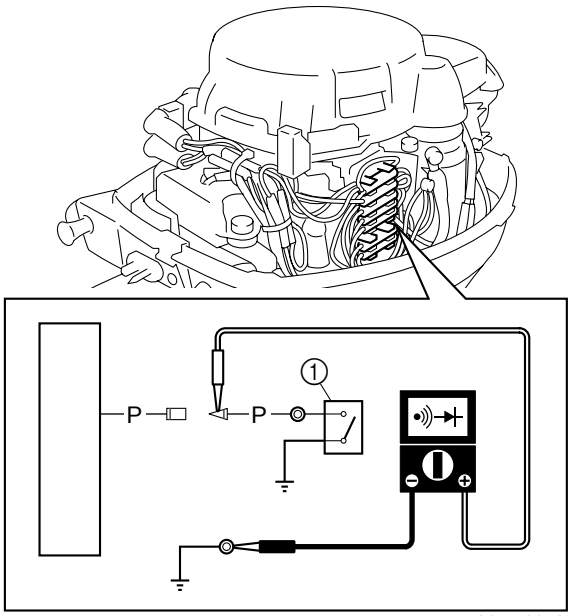
S6AU8047

Oil pressure switch input voltage (reference data):
Pink (P) – Ground
10–12 V

3. Push the engine stop button. (H model)
   Turn the engine start switch to “OFF.” (R model)

8

4. Check the oil pressure switch ① for continuity when the engine is stopped and when it is running. Check the oil pressure and oil pressure switch if out of specification.



S6AU8048

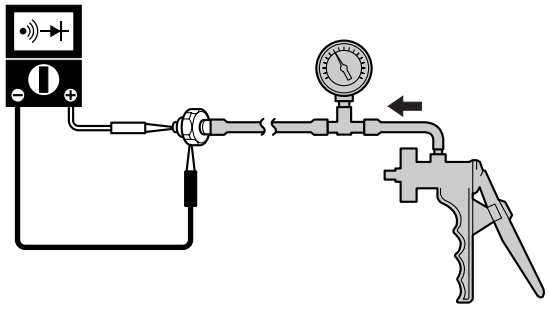
Oil pressure switch continuity:
Oil pressure switch – Ground

Engine condition	Continuity
Stopped	Yes
Running	No

5. Remove the oil pressure switch.

6. Connect the special service tool to the oil pressure switch.

7. Check the oil pressure switch for continuity at the specified pressures. Replace if out of specification.


S6AG8130

NOTE:
Slowly operate the special service tool.

Vacuum/pressure pump gauge set:
90890-06756

Oil pressure switch continuity:
Oil pressure switch – Ground

Oil pressure	Continuity
More than 14.7 kPa (0.147 kgf/cm^2, 2.132 psi)	No
Less than 14.7kPa (0.147 kgf/cm^2, 2.132 psi)	Yes

NOTE:
Apply pressure to the oil pressure switch gradually. The oil pressure switch is operating correctly if the digital tester indication changes from continuity to no continuity in the range of 14.7 ± 4.9 kPa (0.147 ± 0.049 kgf/cm^2, 2.132 ± 0.711 psi).

8. Install the oil pressure switch, and then connect the oil pressure switch connector.

Checking the warning indicator assembly

1. Disconnect the oil pressure switch connector, and then ground the pink (P) lead (wiring harness end).

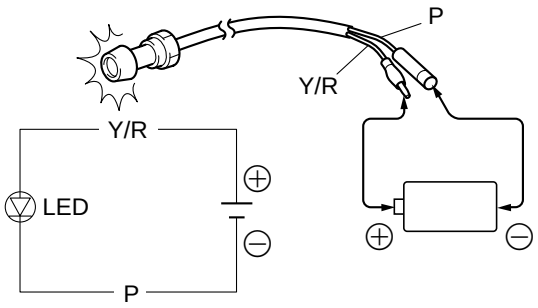
2. Start the engine, increase the engine speed to approximately 2,000 r/min, and check that the oil pressure warning indicator comes on.

3. Push the engine stop button. (H model)
Turn the engine start switch to “OFF.” (R model)

4. Connect the oil pressure switch lead terminal.

5. Disconnect the warning indicator assembly coupler.

6. Connect the yellow/red (Y/R) lead to the positive penlight battery terminal (1.5 V) and connect the pink (P) lead to the negative terminal, and then check that the warning indicator comes on. Replace the warning indicator assembly if it does not come on.



S6AU8051

CAUTION:

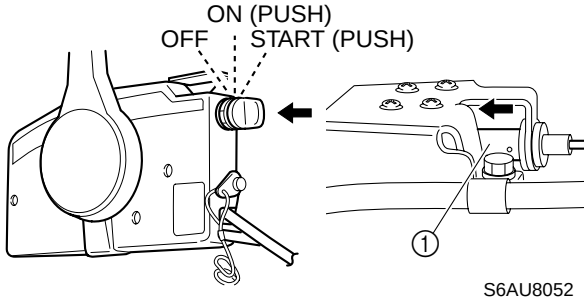
- **Only use a penlight battery (1.5 V) when checking the LED. Other batteries (e.g., alkaline batteries or high-voltage batteries) will damage the diode.**
- **Do not apply more than 1.7 V to the leads when checking the LED.**

NOTE:

A feature of an LED is that it only allows current to flow in one direction.

Checking the choke solenoid (R model)

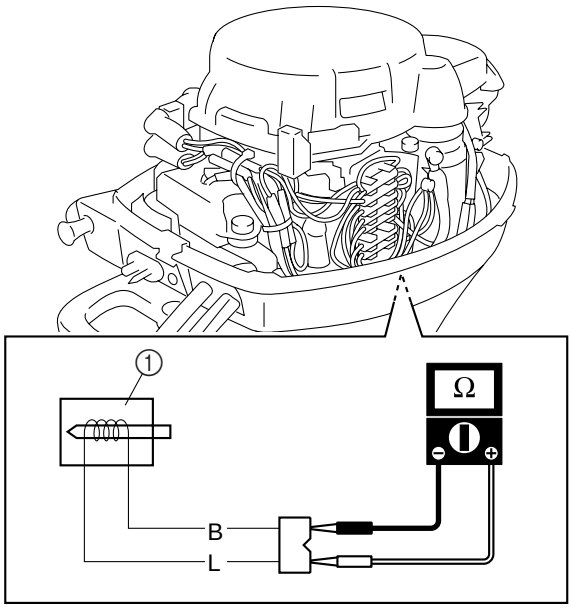
1. Push the engine start switch at the "ON" or "START" position, and then check the operation of the choke solenoid ①. Check the choke solenoid resistance if it does not operate.



S6AU8052

2. Disconnect the choke solenoid coupler.

3. Measure the choke solenoid ① resistance. Replace if out of specification.



S6AU8058

Choke solenoid resistance (reference data):
Blue (L) – Black (B)
4.0 Ω at 20 °C (68 °F)

4. Connect the choke solenoid ① coupler.

Charging system (E model)

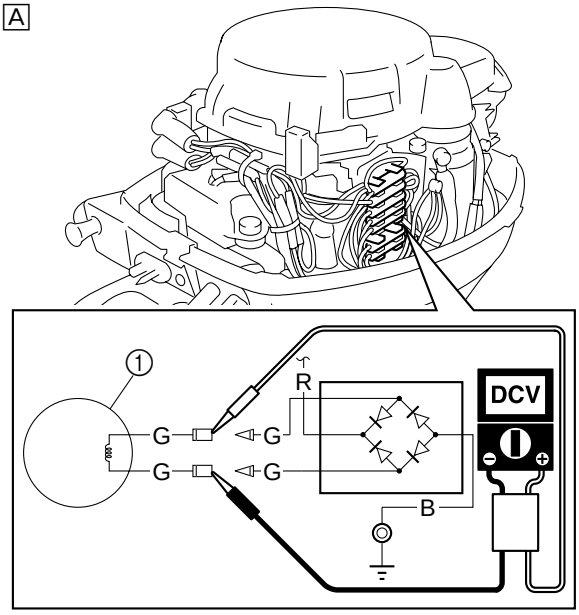
Checking the lighting coil

1. Disconnect the lighting coil connectors.

8

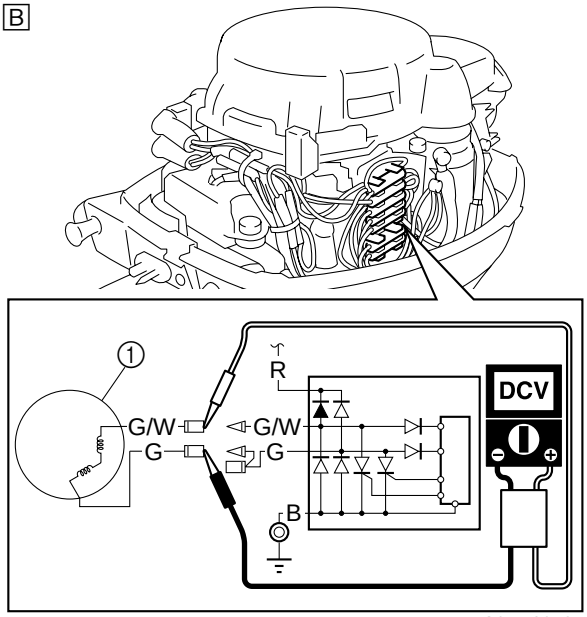
2. Measure the lighting coil ① output peak voltage. Replace if below specification.

A



S6AU8053

B



S6AU8059

A Lighting coil (1 coil)
B Lighting coil (2 coils)

NOTE:

- To prevent the engine from starting when cranking it, be sure to disconnect both spark plug caps.
- Do not remove the clip from the engine shut-off switch.

Lighting coil (1 coil) output peak voltage: Green (G) – Green (G)			
r/min	Unloaded		
	Cranking	1,500	3,500
DC V	6.1	14.6	33.1

Lighting coil (2 coils) output peak voltage: Green/White (G/W) – Green (G)			
r/min	Unloaded		
	Cranking	1,500	3,500
DC V	16.1	33.3	79.1

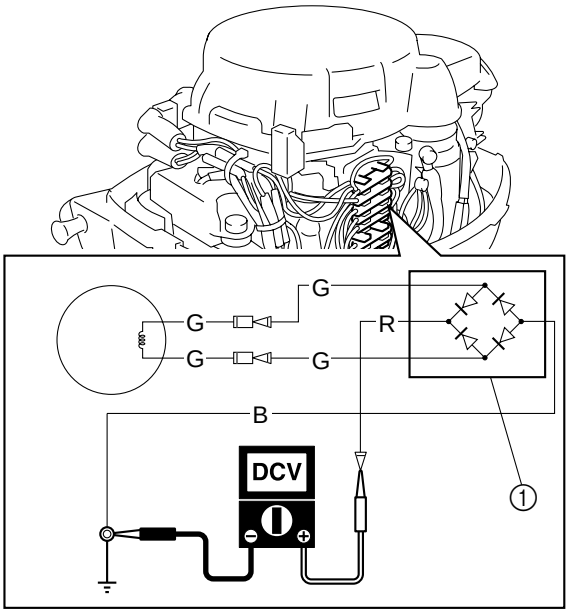
3. Measure the lighting coil resistance. Replace if out of specification.

Lighting coil (1 coil) resistance (reference data):
Green (G) – Green (G)
0.24–0.36 Ω at 20 °C (68 °F)
Lighting coil (2 coils) resistance (reference data):
Green/White (G/W) – Green (G)
0.61–0.91 Ω at 20 °C (68 °F)

4. Connect the lighting coil connectors.

Checking the Rectifier

1. Measure the Rectifier ① output peak voltage. Check the Rectifier for continuity if the output peak voltage is below specification.



S6AU8054

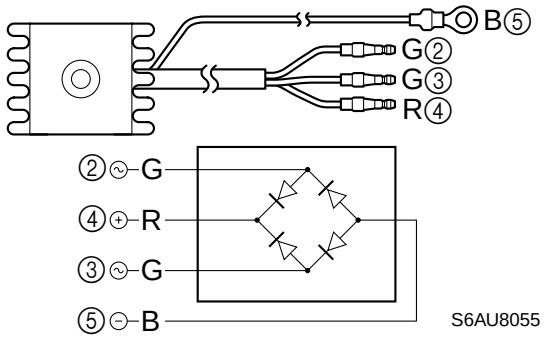
NOTE:
- Do not use peak voltage adapter B when measuring the Rectifier output peak voltage.
- Be sure to check the lighting coil before measuring the Rectifier output peak voltage.

Rectifier output peak voltage: Red (R) – Ground		
r/min	Unloaded	
	1,500	3,500
DC V	13	19

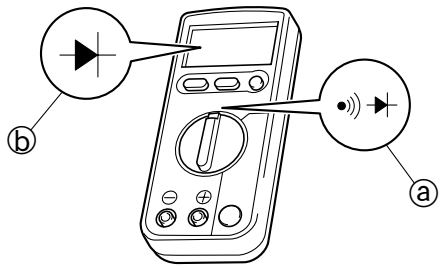
2. Disconnect the Rectifier connector and terminal.

3. Check the Rectifier for continuity. Replace if out of specification.

NOTE:
The voltage values given in the table are for reference only. If voltage is produced, there is continuity, and, if there is an overload, there is no continuity. Refer to the table to determine if there should or should not be continuity and replace the Rectifier if out of specification.



S6AU8055



S6S18360

NOTE:
Be sure to set the measurement range ⓐ, and display the mark ⓑ by pushing the "SHIFT" switch when checking the Rectifier continuity.

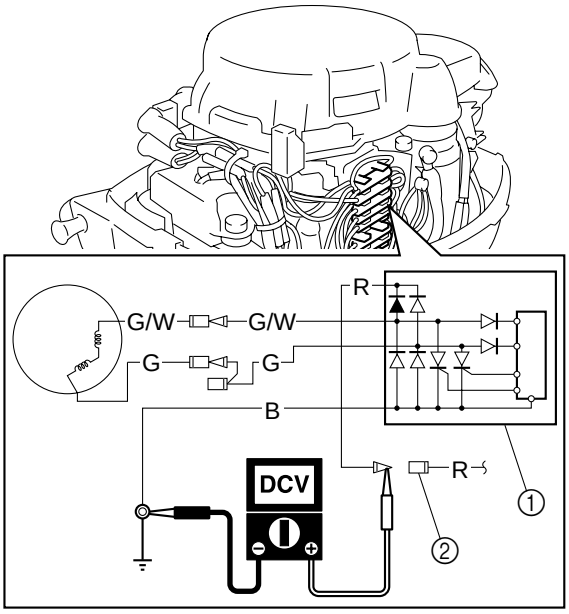
Rectifier continuity (testing diode)			
Tester lead		Display value (V) (reference data)	Continuity
⊕	⊖		
G ②	R ④	0.416	Yes
G ②	B ⑤	OL	No
G ②	G ③	OL	No
G ③	R ④	0.415	Yes
G ③	B ⑤	OL	No
G ③	G ②	OL	No
B ⑤	R ④	0.849	Yes
B ⑤	G ②	0.487	Yes
B ⑤	G ③	0.492	Yes
R ④	B ⑤	OL	No
R ④	G ②	OL	No
R ④	G ③	OL	No

OL: Indicates an overload

8

Checking the Rectifier Regulator

1. Measure the Rectifier Regulator ① output peak voltage. Check the Rectifier Regulator for continuity if the output peak voltage is below specification.



S6AU8060

NOTE:

- Measure the Rectifier Regulator output peak voltage with the connector (R) ② disconnected.
- Do not use peak voltage adapter B when measuring the Rectifier Regulator output peak voltage.
- Be sure to check the lighting coil before measuring the Rectifier Regulator output peak voltage.

Rectifier Regulator output peak voltage:
Red (R) – Ground

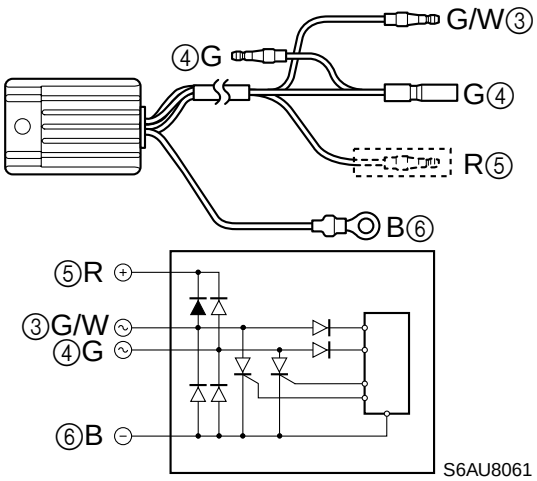
r/min	Loaded	
	1,500	3,500
DC V	13	13

2. Disconnect the Rectifier Regulator connector and terminal.

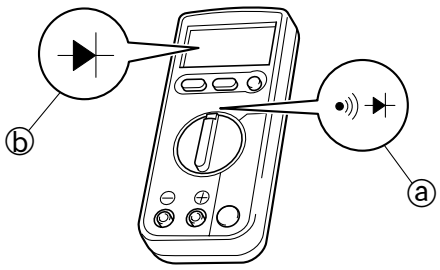
3. Check the Rectifier Regulator for continuity. Replace if out of specification.

NOTE:

The voltage values given in the table are for reference only. If voltage is produced, there is continuity, and, if there is an overload, there is no continuity. Refer to the table to determine if there should or should not be continuity and replace the Rectifier Regulator if out of specification.



S6AU8061



S6S18360

NOTE:

Be sure to set the measurement range ⓐ, and display the mark ⓑ by pushing the "SHIFT" switch when checking the Rectifier Regulator continuity.

Rectifier Regulator continuity (testing diode)			
Tester lead		Display value (V) (reference data)	Conti-nuity
⊕	⊖		
G/W ③	R ⑤	0.364	Yes
G/W ③	B ⑥	0.741	Yes
G/W ③	G ④	1.117	Yes
G ④	R ⑤	0.444	Yes
G ④	B ⑥	OL	No
G ④	G/W ③	OL	No
B ⑥	R ⑤	0.772	Yes
B ⑥	G/W ③	0.432	Yes
B ⑥	G ④	0.434	Yes
R ⑤	B ⑥	OL	No
R ⑤	G/W ③	OL	No
R ⑤	G ④	OL	No

OL: Indicates an overload

8

— MEMO —

TRBL SHTG ?

Troubleshooting

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Troubleshooting the outboard motor

NOTE:

Before troubleshooting the outboard motor:

- Make sure that fresh fuel of the specified type has been used.
- Make sure that the battery is fully charged.
- Be sure to check that the couplers, connectors, and battery terminals are securely connected.
- When checking the input voltage of a part, the coupler or connector must be disconnected. However, be careful not to short-circuit the wiring harness.
- Perform the troubleshooting as described in the following tables.

Troubleshooting table format

Troubleshooting consists of the following 4 items.
Symptom 1: Specific trouble conditions
Symptom 2: Trouble conditions of an area or individual part
Cause 1: Content considered as the trouble causes of symptom 2
Cause 2: Content considered as the trouble causes of cause 1

Troubleshooting the power unit

Symptom 1: Engine does not crank (M model)

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Starter rope does not operate	Shift lever not in the N position	—	Set the shift lever to the N position.	3-10
	Start-in-gear protection cable not adjusted correctly	—	Adjust the start-in-gear protection cable.	3-11
	Manual starter malfunction	—	Disassemble and check the manual starter.	5-8
	Stuck piston	Seizure or rust	Disassemble and check the power unit.	5-1
	Piston lock due to water in the combustion chamber	—		
	Stuck drive shaft	Buildup of foreign material on the spline of drive shaft and bushing	Disassemble and check the lower unit.	6-11 6-32
		Malfunction of the lower unit internal parts		

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Starter rope operates, but the engine does not crank	Manual starter malfunction	—	Disassemble and check the manual starter.	5-8
	Damaged flywheel magnet Woodruff key	—	Check the flywheel magnet Woodruff key.	5-19

Symptom 1: Engine does not crank (E model)

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Starter motor does not operate	Shift lever or remote control lever not in the N position	—	Set the shift lever or remote control lever to the N position.	3-10
	Blown fuse	—	Check the fuse.	8-26
	Engine start button or engine start switch malfunction	—	Check the engine start button or engine start switch.	8-26 8-27
	Neutral switch malfunction	—	Check the neutral switch.	8-27 8-28
	Starter relay malfunction	—	Check the starter relay.	8-29
	Short or open connection in starter motor circuit	—	Check the wiring harness continuity.	WD
	Starter motor malfunction	—	Disassemble and check the starter motor.	8-22

WD: See the wiring diagram.

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Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Starter motor operates, but the engine does not crank	Stuck piston	Seizure or rust	Disassemble and check the power unit.	5-1
	Piston lock due to water in the combustion chamber	—		
	Stuck drive shaft	Buildup of foreign material on the spline of drive shaft and bushing	Disassemble and check the lower unit.	6-11 6-32
		Malfunction of the lower unit internal parts		
	Starter motor malfunction	—	Disassemble and check the starter motor.	8-22
	Damaged flywheel magnet Woodruff key	—	Check the flywheel magnet Woodruff key.	5-19

Symptom 1: Engine does not start (engine cranks)

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Spark plug does not spark	Spark plug malfunction	—	Check the spark plug.	3-5
	Spark plug cap malfunction	—	Check the spark plug cap.	8-30
	Ignition coil malfunction	—	Check the ignition coil.	8-31
	Engine shut-off switch malfunction	—	Check the engine shut-off switch.	8-33
	Charge coil malfunction	—	Check the charge coil.	8-32
	Pulser coil malfunction	—	Check the pulser coil.	8-31
	Short or open connection in ignition circuit	—	Check the wiring harness continuity.	WD
	CDI unit malfunction	—	Check the CDI unit.	8-34

WD: See the wiring diagram.

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Fuel not supplied	Pinched or kinked fuel hose	—	Check the fuel hoses and fuel hose joint.	3-3
	Clogged fuel filter	—	Replace the fuel filter.	3-3
	Fuel pump malfunction	—	Disassemble and check the fuel pump.	4-4
	Carburetor malfunction	Malfunction of the carburetor internal parts	Disassemble and check the carburetor.	4-11
Low compression pressure	Valve clearance not adjusted correctly	—	Adjust the valve clearance.	5-1
	Damaged cylinder head gasket	—	Disassemble and check the cylinder head and power unit.	5-28 5-41
	Damaged valve			
	Valve stuck to valve guide			
	Scratched piston or cylinder			
	Damaged or worn piston ring			

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Symptom 1: Unstable engine idle speed, poor acceleration, poor performance, limited engine speed, or engine stalls

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Intermittent spark	Spark plug malfunction	—	Check the spark plug.	3-5
	Spark plug cap malfunction	—	Check the spark plug cap.	8-30
	Ignition coil malfunction	—	Check the ignition coil.	8-31
	Engine shut-off switch malfunction	—	Check the engine shut-off switch.	8-33
	Charge coil malfunction	—	Check the charge coil.	8-32
	Pulser coil malfunction	—	Check the pulser coil.	8-31
	Short or open connection in ignition circuit	—	Check the wiring harness continuity.	WD
	CDI unit malfunction	—	Check the CDI unit.	8-34
Incorrect fuel and air amount supplied	Pinched or kinked fuel hose	—	Check the fuel hoses and fuel hose joint.	3-3
	Clogged fuel filter	—	Replace the fuel filter.	3-3
	Fuel pump malfunction	—	Disassemble and check the fuel pump.	4-4
	Carburetor malfunction	Throttle stop screw not adjusted correctly	Adjust the throttle stop screw.	3-11
		Pilot screw not adjusted correctly	Adjust the pilot screw.	4-13
		Malfunction of the carburetor internal parts	Disassemble and check the carburetor.	4-11

WD: See the wiring diagram.

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Low compression pressure	Valve clearance not adjusted correctly	—	Adjust the valve clearance.	5-1
	Damaged cylinder head gasket	—	Disassemble and check the cylinder head and power unit.	5-28 5-41
	Damaged valve			
	Scratched piston or cylinder			
	Damaged or worn piston ring			
Throttle valve does not fully open	Throttle control system malfunction	Throttle cable(s) not adjusted correctly	Check and adjust the throttle cable(s).	3-7 3-8
		Throttle link rod not adjusted correctly	Check and adjust the throttle link rod.	3-9
—	Air leakage into intake manifold (carburetor to cylinder head)	Damaged gaskets, spacer, and intake manifold (carburetor to cylinder head)	Check the gaskets, spacer, and intake manifold (carburetor to cylinder head).	4-11

Symptom 1: High engine idle speed

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Engine speed does not decrease when throttle control lever is in fully closed position	Carburetor malfunction	Throttle stop screw not adjusted correctly	Adjust the throttle stop screw.	3-11
		Pilot screw not adjusted correctly	Adjust the pilot screw.	4-13
		Malfunction of the carburetor internal parts	Disassemble and check the carburetor.	4-11
Throttle control lever does not return to fully closed position	Throttle control system malfunction	Throttle cable(s) not adjusted correctly	Check and adjust the throttle cable(s).	3-7 3-8
		Throttle link rod not adjusted correctly	Check and adjust the throttle link rod.	3-9
		Throttle cam not installed correctly	Check the throttle cam.	5-17

Symptom 1: Limited engine speed (below 2,000 r/min)

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
• Buzzer comes on (R model) • Oil pressure-warning indicator comes on	Insufficient engine oil	—	Add sufficient oil.	3-4
	Engine oil pressure decrease	Oil pump malfunction	Check the oil pump.	5-37
		Clogged oil strainer	Check the oil strainer.	7-22
		Clogged oil passages	Check the engine oil passages (power unit and oil pump).	5-28
	Oil pressure switch malfunction	—	Check the oil pressure switch.	8-34

Troubleshooting the PT unit (PT model)

Symptom 1: PT unit does not operate

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
PT motor does not operate	Blown fuse	—	Check the fuse.	8-26
	PT switch malfunction	—	Check the PT switch.	7-55
	PT relay malfunction	—	Check the PT relay.	7-54
	Short or open connection in PT motor circuit	—	Check the wiring harness continuity.	WD
	PT motor malfunction	—	Disassemble and check the PT motor.	7-37
PT motor operates, but the tilt ram does not extend	Manual valve left open	Manual valve malfunction	Check the manual valve.	7-44
	Insufficient PT fluid	—	Add sufficient fluid.	3-13
	PT fluid leakage	—	Check the PT unit for leakage.	7-49
	Clogged filter	—	Disassemble and check the PT unit.	7-44
	Clogged fluid passages			
	Malfunction of the PT unit internal parts			

WD: See the wiring diagram.

Symptom 1: PT unit does not hold the outboard motor up

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
—	Manual valve left open	Manual valve malfunction	Check the manual valve.	7-44
	Insufficient PT fluid	—	Add sufficient fluid.	3-13
	PT fluid leakage	—	Check the PT unit for leakage.	7-49
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	Clogged fluid passages	—	Disassemble and check the PT unit.	7-44
	Malfunction of the PT unit internal parts			

Troubleshooting the lower unit

Symptom 1: Shift mechanism of the forward gear and reverse gear does not operate properly

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
—	Shift cable and shift cable joint malfunction (R model)	—	Check and adjust the shift cable and shift cable joint. (R model)	3-10
	Remote control box malfunction (R model)	—	Check the remote control box. (R model)	3-10
	Shift rod cam malfunction	—	Check the shift link rod.	3-10
		Detent malfunction	Check the shift rod cam.	7-14
	Shift rod operation malfunction	Shift rod not connected correctly	Check the connection of the shift rod.	6-15 6-37
		Shift rod not adjusted correctly	Adjust the shift rod.	6-15 6-37
	Shift mechanism malfunction (in lower unit)	—	Disassemble and check the lower unit.	6-7 6-27

Symptom 1: Cooling water does not discharge from the cooling water pilot hole

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
—	Clogged cooling water inlet	—	Check the cooling water inlets.	3-7
	Clogged cooling water passages	—	Check the cooling water passages.	3-7
	Incorrectly connected cooling water hose			
	Damaged water pipe or incorrect installation	—	Check the water pipe and its installation.	6-15 6-37
	Water pump malfunction	Damaged water pump impeller	Check the impeller.	6-5 6-25
			Check the Woodruff key.	6-5 6-25
		Water leakage from water pump housing	Check the water pump housing.	6-5 6-25
			Check the insert cartridge.	6-5 6-25
			Check the outer plate cartridge.	6-5 6-25

A.

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— MEMO —

Wiring diagram
Pike 9.9 M

① CDI unit
② Pulser coil
③ Lighting coil (1 coil)
④ Lighting coil (2 coils)
⑤ Charge coil
⑥ Oil pressure switch
⑦ Rectifier
⑧ Rectifier Regulator
⑨ Ignition coil
⑩ Spark plug
⑪ Fuse (10 A)
⑫ Battery
⑬ Engine shut-off switch
⑭ Oil pressure-warning indicator

Ⓐ Optional

Color code

B : Black
Br : Brown
G : Green
L : Blue
O : Orange
P : Pink
R : Red
W : White
Y : Yellow
G/W : Green/white
W/R : White/red
Y/R : Yellow/red

Wiring diagram
FT9.9GE, FT9.9GEP

① CDI unit
② Choke solenoid
③ Pulser coil
④ Lighting coil
⑤ Charge coil
⑥ Oil pressure switch
⑦ Starter motor
⑧ Rectifier Regulator
⑨ Ignition coil
⑩ Spark plug
⑪ PT motor (PT model)
⑫ PT relay (PT model)
⑬ Fuse (10 A)
⑭ Battery
⑮ Starter relay
⑯ Oil pressure-warning indicator

Ⓐ To remote control box
Ⓑ PT model

Color code

B : Black
Br : Brown
G : Green
L : Blue
Lg : Light green
O : Orange
P : Pink
R : Red
Sb : Sky blue
W : White
Y : Yellow
G/W : Green/white
W/R : White/red
Y/R : Yellow/red

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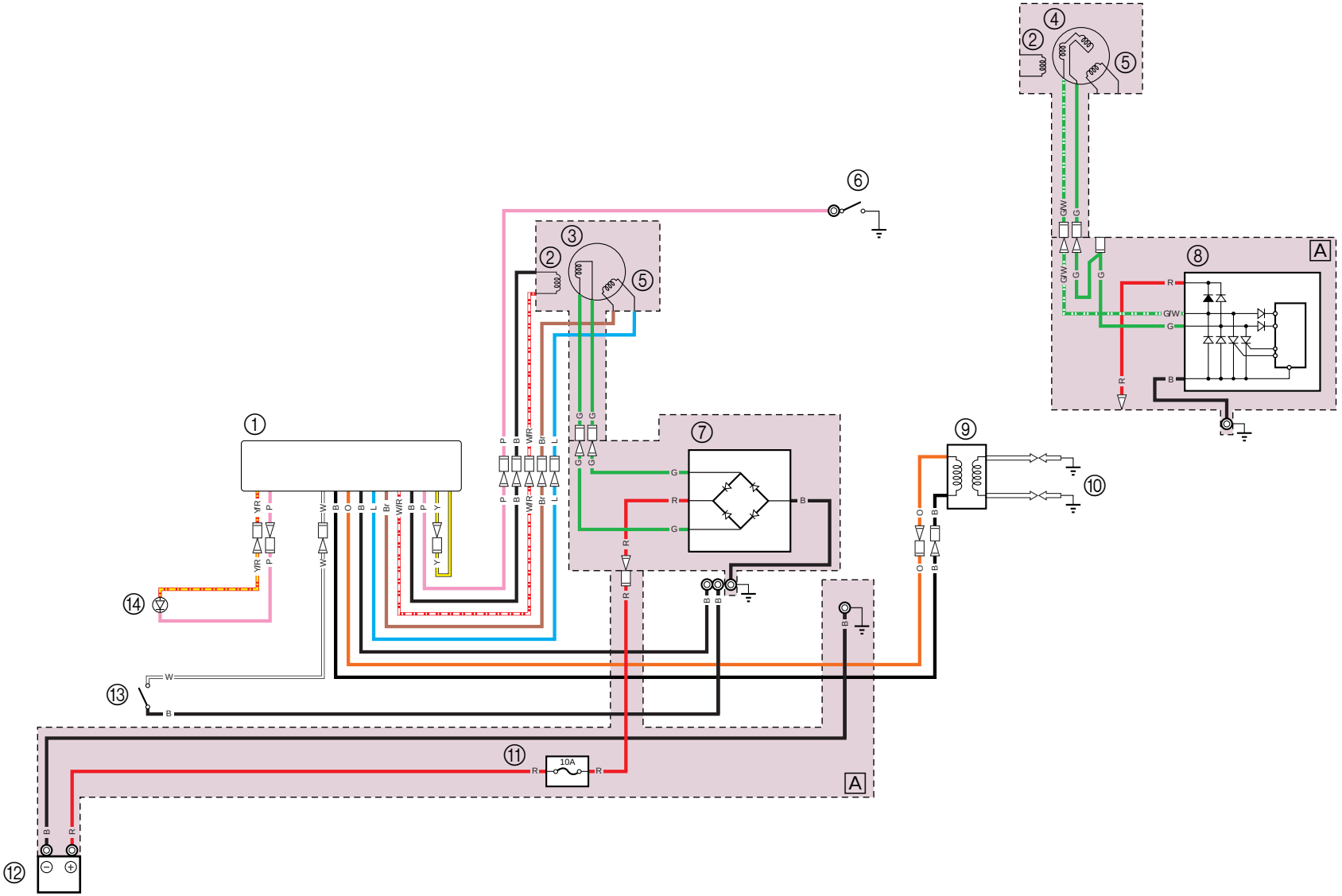

Pike 9.9 E